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FEBRUARY 1986
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SLDD
Sansui STEREO CONTROL AMPLIFIER C-2101
Sansui STEREO POWER AMPLIFIER B-2101
TU-D99X SLDD Digital Synthesizer Tuner
C-2101 Stereo Control Amplifier
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THIS MONTH'S COVER

Pictured on the front cover is the Yamaha R9B, one of the winners of this year's hifi awards. You can find out about the other winners by turning to page 8.

Electronics Australia

Volume 48, No 2

February 1986

Features

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Radio Direction Finder

Want to find out where a radio signal is coming from? Or locate an illegal transmitter? This radio direction finder will track it down using an electronically rotated antenna. Details page 26.

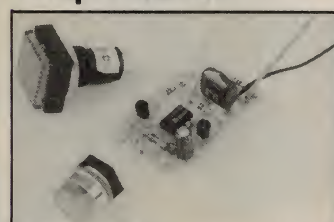
What's coming

Next month we will present a special feature on AM stereo and describe a digital strobe circuit. See page 14 for further details.

Record reviews

Because of the length of the CD directory, we will be delaying the introduction of our CD reviews until the list is completed.

Dashboard lamp flasher



This is the "Claytons" car burglar alarm — the alarm you fit when you can't be bothered fitting a real alarm. It's both easy to build and easy to install (see page 38).

News Highlights

Resurrection of an old IC logic

Ferranti Electronics Ltd of the UK has resurrected an obsolete bipolar logic form called differential current-mode logic (DCML). DCML is being used to develop a prototype 16-bit multiplier that can combine very high speed with a limited power consumption.

Its main attraction has been its ability to reject common-mode noise. Using the differential long-tail pair has the advantage of cancelling out spurious signals, crosstalk and noise.

Why has this once discarded logic circuitry (which was unpopular because of the circuit complexity that came with carrying signals on two lines instead of one) found itself in favour again? Firstly it comes down to the cuts in power that it can affect and secondly: advances in computer-aided-design (CAD), technology have made the circuit complexity invisible to the logic designer.

Furthermore, logic circuits designed from stacked DCML gates perform their functions in fewer cycles than their equivalent single-logic-level circuits. This makes the whole process up to four times faster. The power use also is reduced which is an added bonus.

The final product, developed by Ferranti and used in airborne radar systems, is a single chip multiplier that consumes 1 W of power as compared to a board full of chips which would consume 16 W. It can multiply two 16-bit values in 25 nanoseconds.

The hardware "hackers"

Looking like a scene from a computer enthusiast's nightmare, this is the first stage in a process that recycles redundant computer hardware into steel, copper, aluminium and precious metals for tomorrow's industry.

Screens once studied by clerks are unmercifully smashed — to prevent them exploding — while the miles of cable that carried complex programs are pulled out and stripped for their copper.

Hundreds of tonnes of computers are scrapped each week. One company, Walmax Processing has invested 1.5 million pounds in a refinery to extract and purify the palladium, silver and gold that are widely used on the circuit boards of an average computer system.

The British company will extract some 6,000 ounces of gold this year and, with offices already operating in France, Italy and Germany, it intends registering with the London Metal Exchange as a supplier of gold bullion.

Computerised textile design

Called the Dobby Designer, this equipment allows the weaver/designer to enter draft patterns and see the likely effects in "fabric" form on the colour screen. Any pattern which appeals can then be woven in cloth on the loom.

Once the pattern has been passed over from the screen by a BBC microcomputer, the loom's controller gives the selection of shafts in the correct sequence so that the cloth is woven to the chosen design. The design can be revised as the cloth is being produced.

On-screen design of textiles is possible in eight colours and the pattern can be built up and recorded on a floppy disk, making the production of samples of cloth simpler and quicker.

Traditionally, many designers turn their sketches into sample cloths by manually setting up a small hand loom — a process which is tedious and time consuming.

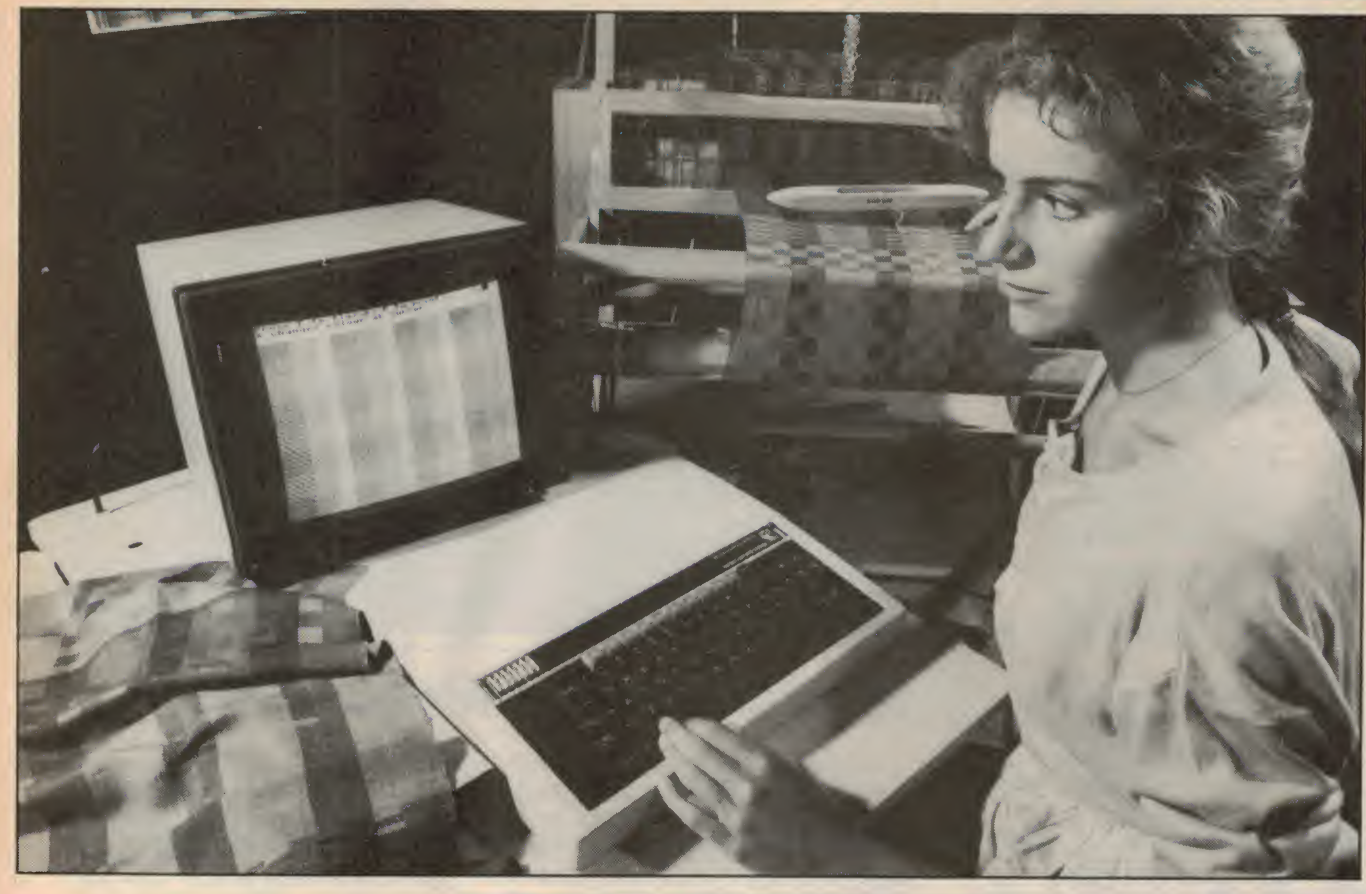
With this method, the pattern is composed in detail on the screen and the data fed from disc to loom controller, allowing lifts and shafts to be selected to produce the corresponding pattern in the woven cloth.

Plasma display seminar

OKI Electric Industry Co. is a leading Japanese manufacturer of Plasma Displays. Their range is from two lines of 32 characters to 24 lines of 80 characters. In conjunction with Amtex Electronics, a one-day seminar on the subject of plasma displays is planned, covering topics such as: comparison of various display technologies; how plasma displays are manufactured; current applications and technical aspects of designing with plasma displays.

The seminars are planned for Adelaide (24th February), Melbourne (25th February) and Sydney (27th February).

For further information, contact Amtex Electronics on (02) 728 2121.



The controller has a memory able to deal with a weaving pattern of up to 480 lifts. In addition, the lift pattern is divisible into as many sub-patterns as the designer requires. The controller can also be instructed to repeat patterns automatically.

Dial an advert

Japan's national telecommunications company, Nippon Telegraph and Telephone (NTT), is out to find a new source of revenue to replace the loss of its lucrative monopoly on long-distance calls due to deregulation.

The plan is to sell a new advertising medium — the telephone call. The latest space for advertisers is now only a ring away.

Two methods are being tried. A company may have consumers who ring their stores listen to a 10-second promotion and then, at no expese to the caller, be put through to the wanted number.

Alternatively, information operators will read an advertiser's message to anyone ringing for a particular phone number in the advertiser's specific field.

The final attempt to improve NTT's lagging profile involves distributing bottles of private label shochu (a cheap, popular liquor), with the company's name prominently displayed upon it.

Speeding a thing of the past

In Japan it looks as if high speed car chases, which endanger the lives of not only the offender but the police and the public as well, may eventually be averted.

The Japanese National Police Agency has begun testing an infrared camera system which will photograph any speeding motorist and their licence plate, day or night.

Using optical fibre links running from the special camera to the central police computer terminal, information such as speed, time, date and location can be relayed, as digitised images, back to the authorities. Here, the information is matched against lists of repeat offenders and stolen cars and the suspect is on the way to being apprehended.

Semiconductor war continues

The battle over semiconductor production and the export and import of these important devices is still continuing between the US and Japan.

The Japanese are anticipating cutbacks to their exports as the US continues to import less and less from them. There is also the added problem of impending legislative action which will correct what the US feels is a trade imbalance in the semiconductor market.

Market pressures are also a major consideration in export cutbacks. The fall off in the US in computer buying indicates that the market will continue to slump.

In Japan the production of semiconductors is still increasing, to the point where in real terms the Japanese will still effectively increase their semiconductor exports to the US. This will further exacerbate the trade imbalance.

News Highlights

New semiconductor assembly technology

A new semiconductor assembly technology called Film Carrier Assembly Technology has been patented by Matsushita. The process involves forming electrode bumps which bond leads with an IC chip, resulting in thinner smaller chips.

The bumps are formed on the film carrier, rather than on the IC chips as is done in the conventional film carrier method. The bumps are formed on a glass substrate and are then transferred to the carrier leads. The film carrier is bonded to the IC chip by heat pressing.

According to Matsushita, the new process is much simpler and much less expensive than forming them on a substrate.

Applications in the semiconductor industry include IC card systems, liquid crystal display systems and multiple ICs and LSIs.

New computers for US Space Shuttles

The computers used in the US Space Shuttle are certainly not very reliable. In 20 missions orbiters have suffered five computer failures, two of which have caused 24-hour delays to the respective spacecraft.

The most recent failure, on August 25th, delayed the launch of the orbiter *Discovery*.

IBM began developing the existing systems for the shuttles in 1972, under a timetable that called for five years of pre-flight testing and a first launch in 1979. IBM delivered on time but the rest of the shuttle was not as prompt. All this adds up to the fact that the computing equipment on these orbiters is the best of the early 70s!

In 1987, the shuttle fleet will be fitted with new generation computers which are half the size of the old ones and half the weight. Each of the machines consists of two tape drives holding 134 M-bytes with a core memory of 256K in 32-bit units. The power consumption of the new system is also lower at 550W rather than 650W, and it is faster and much more reliable.

Flat screen pocket TV

The Sinclair miniature pocket TV receiver has recently been released in Australia and will sell for about $399.

Featuring a revolutionary flat-screen cathode ray tube, the pocket receiver is built around a single LSI chip. There are just two controls: on/off, volume and tuner. Power is supplied by a lithium power card which provides 15 hours of life.

The screen size is just two inches (5cm), while the external dimensions are 140 x 90 x 30mm.

Second Australian hifi awards attract big field

CESA hifi Grand Prix awards

The second year of the Australian hifi awards attracted no less than eighty entries and the judges declared winners in all eight categories. One brandname hit the jackpot with awards in two categories: Sony.

by LEO SIMPSON

1986 is the second year that the Australian hifi awards, known as the CESA Grand Prix awards, have been made. By contrast with the inaugural year for the awards, there was no shortage of entries this year so the judges had plenty of work in sorting the leaders from the also-rans.

Just about every major brand was represented, and most of these had entries in more than one category. Let us list each category in turn, and the products submitted.

Amplifiers

This category embraces integrated stereo amplifiers and preamplifier/power amplifier combinations. There were 12 entries in all, ranging in price from a few hundred dollars up to many thousands. Cheapest was the Yamaha A320B integrated stereo amplifier which is rated at 30 watts per channel and priced at $299.00. Dearest was the Nakamichi CA-5 preamplifier and PA-7 power amplifier combination which has a rated power output of 200 watts per channel and a total price of $5000.

We should note that many of the products mentioned in this report have undergone price rises since the judging of the awards, due to the decline in the Australian dollar.

The other amplifier entries were as follows:
Amber Series 70 power amplifier, 70 watts per channel, $1995.00;
Electrocompaniet power amplifier, 75 watts per channel, $2990.00;
JVC A-X500VB integrated stereo amplifier, 100 watts per channel, $979.00;
Luxman LV105 "Brid" integrated stereo amplifier, 85 watts per channel, $1298.00;
NAD 1155 preamplifier and 2200 power amplifier, 100 watts per channel, $1368.00;
Pioneer A-88X integrated stereo amplifier, 120 watts per channel, $1199.00;
Sansui AU-G77X integrated stereo amplifier, 110 watts per channel, $1099.00;
Sharp SM207X integrated stereo amplifier, 40 watts per channel, $1299.00;
Sony TA-F444ES-II integrated stereo amplifier, 100 watts per channel, $999.00;
Technics SU-V10X integrated stereo amplifier, 120 watts per channel, $1329.00.

Amongst these 12 entries are some very good amplifiers and ones which have some quite interesting features. The Luxman "Brid", for example, uses

Sony's CDP-502ES was the winning entry in the CD player category. It has a unique feature: remote volume control.

triode valves in the driver stages of the power amplifiers. It's a strange circuit, with a dual FET differential input stage feeding the triodes which then drive the Mosfet output stages.

Luxman don't do much to justify it though, except for some flowery language in their pamphlet such as, "Superb sonic quality and powerfulness are realised, providing concert-hall realism, non-distorted and glossy feelings, etc".

Sansui's AU-G77X is one of the more unusual entries, laying claim to be "the world's first fully balanced signal amplification and transmission system". It is indeed fully balanced (as described in a number of professional engineering journals) and Sansui claim that the benefit is complete freedom from electromagnetic interference, induced hum and common impedance signals.

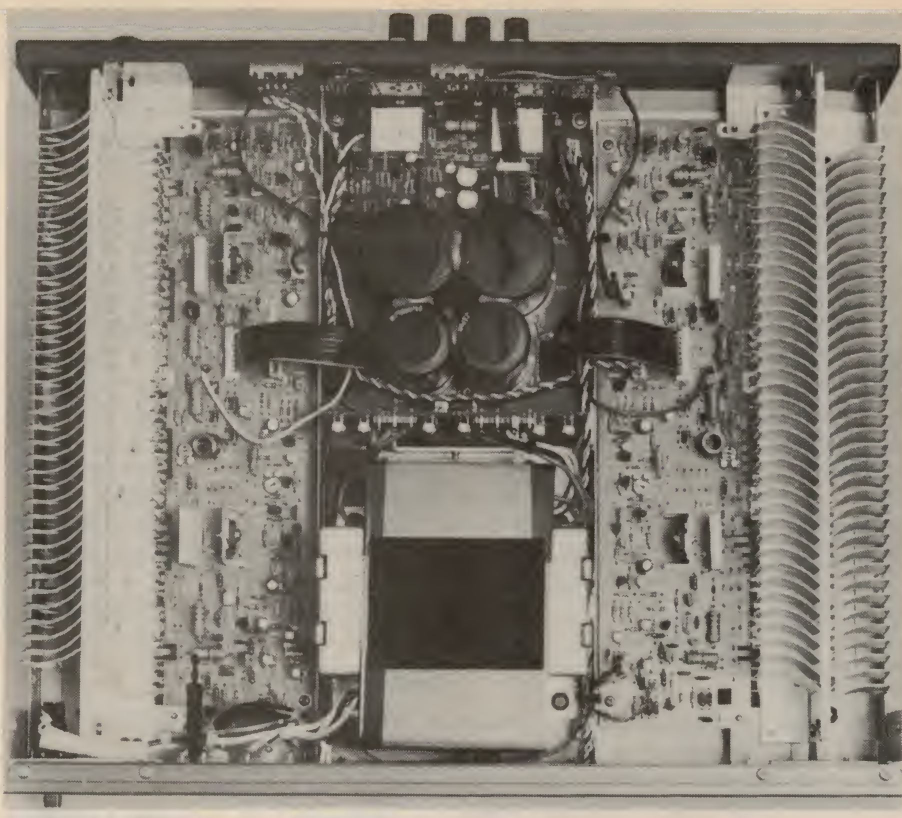
It is one of the more powerful entries and claims very good performance figures, such as a frequency response flat from DC to the −3dB point at 200kHz (for the Auxiliary inputs).

JVC's A-X500VB abounds in jazzy user features, such as Gm selector, computer-controlled seven-band equaliser and analyser together with fluorescent bar-graph display, three video inputs (for video dubbing) and a total power output of 110 watts per channel.

By contrast, Yamaha's A-320 would have to be one of the most spartan available, outdoing just about any European model.

It has five push-buttons for source and mode selection, plus a ganged volume control. Apart from those and a headphone socket, it is devoid of features and so it should appeal to those puritanical types who think that tone controls and any other controls are strictly unnecessary.

Its particular merit is the ability to deliver high music power and drive very low impedance loads to considerably higher power than its modest 30 watt per channel would indicate. It was to rate among the final contenders on performance, price and design merit.



Inside the NAD 2200, which won the best amplifier award.

Minor judging hassles

Unfortunately, the Sharp entry for the amplifier category had to be disqualified by the judges as it is only available as part of a complete system, viz, the Sharp 207X(S). This rule was to act against most of the Sharp entries in other categories, since they too were only available as part of a particular mid-sized music system.

In the categories for CD players, loudspeakers and cassette decks, there were instances where more than one entry was made for a particular brand name which is also not allowable under the rules. In these cases, the judges were forced to disallow one entry from each of the companies concerned. This in fact meant that the companies got the benefit of having two entries in. As it happened, the winning result of the particular categories was not affected.

These quandaries really should have been prevented by the organising committee but inevitably, late entries on the part of some companies would have caused disorganisation.

The winning entry was the NAD 1155 preamplifier and 2200 power amplifier combination. The 2200 power amplifier offers exceptional short-term power output (up to 900 watts per channel) plus the ability to operate in bridge mode for even higher mono output, and has such innovative features as soft clipping and out-of-phase operation of the power amplifiers for better power supply utilisation.

It is a very clever design teamed with a very good preamplifier. (The NAD combination was reviewed in *Electronics Australia* in the November 1985 issue.)

Receivers

Judging this category was much easier as there were only five entries: JVC R-X400, NAD 7155, Sharp SA-118HS (disqualified, see note above), Technics SAR-100 and Yamaha R-9B.

As with the JVC amplifier, the R-X400 is something of a technological tour-de-force, with far more features than any other in its category. Rated at 80 watts per channel, it too has a com-

The winning receiver entry was Yamaha's feature-laden R-9B.

puter controlled analyser equaliser with a very fancy multicoloured liquid crystal display which indicates virtually every facet of all the receiver's operating modes.

Its synthesised FM/AM tuner has no less than 15 presets for both AM and FM and it has inputs for both moving magnet and moving coil cartridges. Surprisingly, JVC entered the R-X400 in preference to the top-of-the-line model R-X500 which also offers the luxury of full remote control of all functions. Price of the R-X400 was $899.00.

The NAD 7155 is quite similar in features to the model 7140 which won its category in the inaugural awards. Indeed, its very similarity to the 7140 helped the judges to decide that it did not represent a major advance on the 7140 and therefore could be eliminated from the final contenders. Price of the NAD 7155 was $999.00 for a rated power output of 75 watts per channel into 8Ω loads.

Technincs' SAR-100 entry was a little out of the ordinary. It is a very compact music system which includes stereo cassette player with Dolby B and C Noise reduction. All functions are adjustable by the infrared remote control and the slimline styling of the system is complemented by the flat honeycomb loudspeakers. The whole ensemble is intended to be hung on a wall.

As such, it makes an attractive and compact system but the judges felt that its modest power output of 30 watts per channel meant that it could be used satisfactorily with only a limited range of loudspeakers, should the user wish to substitute for the honeycomb units, which are not an option. The SAR-100 was the dearest receiver entry, at $1459.00.

The fifth entry, the Yamaha R9B, must be one of the most feature-laden receivers available, regardless of price. Beautifully finished in sombre black, it has so many controls that half of them are concealed behind a wide, flip-down door. To list all the features would take up more space than we could spare but perhaps one feature is an indication of the thought that has gone into the design.

As with a number of top-of-the-line receivers, the Yamaha R-9B has an infrared remote control. But the R-9B has a conventional volume control with a LED-illuminated pointer which can be used just like a control on any amplifier. When you use the remote control, the volume control rotates by itself which is not only very snazzy but it gives an immediate and unmistakable indication of the volume setting.

Suffice to say that the Yamaha won the receiver category with very little debate from the judges. It is priced at $1399.00 and as with all Yamaha audio products, has a five-year warranty.

Best tuner

Eleven models were entered in this category, listed as follows:

Amber model 7	$ 995.00
Audiosound AM101	$ 649.00
JVC TX-900B	$ 729.00
NAD 4155	$ 539.00
Nakamichi ST7	$1250.00
Pioneer F-99X	$ 599.00
Sharp ST-207X	system $1299.00
Sansui TU-D99AMX	$ 899.00
Sony ST-S444ES-II	$ 549.00
Technics ST-G6T	$ 599.00
Yamaha T1020B	$ 499.00

Of the eleven tuners, only two offered the feature of AM stereo reception and only one of these is Australian made, by Audiosound Laboratories. Unfortunately, it is AM only and manually tuned, whereas all the other tuners under consideration are fully synthesized.

Of the others, the Sony model stood out as a particularly good performer at a relatively low price. It is also very well finished. It was reviewed in the December issue of *Electronics Australia.*

Other tuners which stood out as being good performers at a good price were the NAD 4155 with its "dynamic separation" circuit and the Pioneer with its very good ultimate signal-to-noise ratio.

Ultimately though, the judges felt that they could not ignore the fact that Australia now has AM stereo broadcasts and that only one of the tuners submitted met the twin criteria of good FM performance plus the capability to receive AM stereo. The model in question is the Sansui TU-D99AMX. Its FM specification is particularly good and its AM bandwidth is better than average. It was clearly the winner of its category.

Cassette decks

Aiwa ADWX 220	$ 787.00
Akai GX-9	$1049.00
JVC KC-V6	$ 679.00
NAD 6155	$ 549.00
Nakamichi BX-300	$ 999.00
Pioneer CT-A9X	$1499.00
Sharp RT-207XS	system $1299.00
Technics RS-B66W	$ 889.00
Toshiba PC-G16	$ 169.00
Toshiba PC-G46WR	$ 379.00
Yamaha K-1020	$ 899.00

Of all these machines, one model clearly stood out for popularity, performance, features, the lot . . . the Nakamichi BX-300. It was no contest at all.

Turntables

Ten products were submitted within this category, one being a phono cartridge:

Aiwa PX-E10	$ 239.00
Akai AM-A90	$ 949.00
Dual CS-5000	n.a.
Logic DM-101	$1295.00
Sharp RP-207X	system $1299.00
Shure Ultra 500	$1212.00
Sony PS-X555ES	$ 799.00
Systemdek IIX/Profile II Arm	$ 549.00

Thorens TD 320	$ 799.00
Yamaha PF-1000	$ 999.00

Two turntables stood out in the judges' minds: the Yamaha PF-1000 and the Thorens TD320. Both are fairly conventional in overall presentation although the Yamaha has a rather unusual twin-tube design which is claimed to be advantageous in damping out arm resonances. Both the turntables are belt-driven too although so are the Logic DM-101 and Systemdek.

The final clincher, as far as the Thorens was concerned, was its proven reputation for performance and reliability which has been carefully refined over many years from the original TD124 model. So Thorens won, which is sure to appeal to the traditionalists among hifi (and analog) enthusiasts.

The award-winning Thorens TD 320 has electronic speed selection and belt drive.

Compact disc players

In view of the over-riding interest in CD players and the very large number of models available, as indicated in the listing published in last month's issue, it is surprising that there were not a lot more entries in this category.

Eleven models were submitted:

Aiwa DX1500	$ 735.00
Akai CD-A7	$ 699.00
NAD 5255	$ 899.00
Nakamichi OMS-5	$1795.00
Nakamichi OMS-7	$2400.00
Pioneer PD-9010X	$ 999.00
Sharp DX-220H	$ 499.00
Sony CDP-502ES	$1349.00
Technics SL-P3	$ 839.00
Toshiba XR-V11	$ 479.00
Yamaha CD-3	$ 749.00

Five of the CD players have remote control, with the cheapest of these being the Yamaha CD-3. In view of Yamaha's record so far with CD players (Yamaha won last year, with the CD-X1), it was perhaps inevitable that it would be amongst the final contenders. The other two in the final few were the Sony CDP-502ES and the Nakamichi OMS-7. While the judges all agreed that the Yamaha was a good performer at a good price, the final decision was

Sansui's TU-D99AMX won the best tuner award and was the only one of two entries which featured AM stereo.

among the two top-of-the-liners, Sony and Nakamichi.

Both these machines are superbly finished and very thoughtfully designed. The Sony has one unique feature though: remote control of volume. Would that other CD players had this feature . . . it's a beauty. The judges also felt that the Sony had the edge in overall performance over the Nakamichi and that, at a good $1000 under the price of the OMS-7, the Sony was a clear winner.

Loudspeakers

Eleven loudspeakers were up for judging, listed as follows:

Audiosound 8035	$1060.00
B&W Active I	$4750.00
B&W 808	$8600.00
DCM Time Window 3	$3600.00
KEF GT-200	$ 999.00
NAD 20	$ 799.00
Pioneer DSS-9	$1599.00
Sony APM-22ES	$ 769.00
Technics SBR 100	$ 479.00
Triad 70	$1295.00
Yamaha NS-1000x	$3599.00

That is quite a line-up with some very expensive loudspeakers present. Both the B&W models are regarded as superb performers, the Active 1 being especially so. It is essentially a complete music system, needing only the sources such as turntable, tuner and compact disc to be connected to its control unit.

Each loudspeaker enclosure is a three-way system, especially equalised and driven by a 200W amplifier for the bass and midrange units while the tweeter is driven by its own 100W amplifier. Both amplifiers are Mosfet-powered and have very low distortion, typically below .003%.

The Yamaha NS-1000x also has a very high reputation, being regarded as one of the best loudspeakers ever to come out of Japan and a great speaker in its own right. Essentially, it is a refinement of the already refined NS1000m which has been around for some time. The NS1000x is a three-way system with the ultralight beryllium tweeter and midrange drivers of the NS-1000m plus the new carbon fibre woofer of the NS-2000 model. In addition, the front corners of the cabinet have been smoothly rounded to minimise high frequency diffraction effects.

Time Windows

Within a dollar of the Yamaha loudspeakers are the DCM Time Windows. They employ a folded transmission line enclosure for bass loading of the two bass/midrange drivers and have a 19mm soft dome tweeter which is ferro-fluid cooled for high power handling. They are claimed to have exceptional stereo imaging and to be quite non-critical of room placement and listening position.

The maverick entry in the loudspeaker category was the Kef GT200 loudspeakers. These are a highly innovative design drawing on the research background for the award-winning Kef 104.2 loudspeakers. They are most effective in producing a lot of bass in a car but the judges felt that they really did not fit into this category. Had there been an award for car sound equipment, the GT-200s would have been strong contenders.

Pictured above is the the Triad 70 satellite loudspeaker system, shown with optional stands.

Another innovative design was the Sony APM-22ES. This bass reflex system uses a square and flat aluminium honeycomb woofer driven at four "sweet spots" from a common voice coil. The tweeter is also flat and square although just how this improves on a conventional dome tweeter Sony have not explained. The cabinet is another of the systems that have rounded front corners to reduce diffraction effects.

The decision on the winner amounted to a piece of lateral thinking by the judges. This awarded the prize to the little-known Triad 70 system. This is a satellite design, with two very compact two-way enclosures complemented by an almost as compact sub-woofer enclosure with its own inbuilt 70W power amplifier. These have very good sound quality, are affordable by a reasonable proportion of the populace and can be used in so many of today's smaller homes and home units.

Technological development

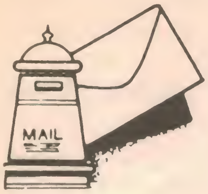
This category tended to be a grab-bag of entries of all sorts of equipment some of which, in the judges' opinions, were a bit of a joke, hardly being innovative at all. Readers can judge for themselves whether or not all of them were worthy.

The list of entries is as follows:

Aiwa CTX-500 cassette deck; dbx Soundfield loudspeakers; Jecklin "float" stereo headphones; JVC Crossmedia audio/video systems; Polk SDA CRS loudspeakers; Monster Cable Powerline 3; Sharp QT-94Z double cassette music system; Sony D-50 portable CD player; Technics SH 8066 graphic equaliser/analyser; Yamaha C2X preamplifier/B2X power amplifier.

All right, there were some innovative products of note in there, such as the dbx Soundfield speakers (reviewed in the March 1985 issue of EA), the Jecklin headphones and a couple of others. But there is one product which stands out like a beacon as far as technological development is concerned, the Sony D-50 portable CD player. Fair dinkum now, could it have been any other? The judges did not debate it at all.

Who were the judges? They were Greg Borrowman, editor of *Australian Hifi*, David Frith, audio and video writer for *The Sydney Morning Herald* and Leo Simpson, editor of *Electronics Australia*.



Letters to the editor

Star Wars is not the answer

While the daily papers may be a better forum to debate 'Star Wars', R.J. Long's (Dec. 1985) enthusiasm for a cheap, effective and low technology missile defence system must be tempered by reality. The scenario of 10,000 warheads being 'torn to pieces' would be an environmental disaster second only to 10,000 nuclear detonations.

Among the debris raining to earth would be one hundred tonnes of plutonium 239 from the trigger devices (10kg per warhead). Plutonium 239, with a half-life of 24,400 years, is our most toxic substance.

There is no 'safe' dose, with either an early death from the radiation, or from cancer, some years later. It is neither biodegradable nor chemically inactivated. It can only be safe when totally isolated from the environment.

In the year 26,400 AD, our children, one thousand generations from the fathers of the atomic age, will still be dying from the effects of the 50 tonnes of this plutonium, still unchanged from the day we first manufactured it in our military and power reactors.

If we cannot have nuclear-free peace, then Armageddon may be preferable.

R.A. Vickers,
Mt. Waverley, Vic.

Reviewers: a vote of thanks

A vote of thanks to your anonymous band of reviewers.

They too contribute to the final judgement by the reader of the quality of EA, but may be overlooked by editor and reader alike in the quest for the latest and greatest in electronics.

This year I enrolled in a 3rd year electrical maths course but this "serious hobbyist" soon found himself deficient in circuit theory.

The review of 'Electric Circuits, Theory and Engineering Applications' by Durney et. al. (EA, July 1985), by describing the author's approach to the topic, as well as detailing the contents of the book and assessing the audience most suited, enabled this reader to decide it was tailor-made for his situation.

I thank these reviewers and remind the editorial staff of their contribution to the totality of EA.

D. Larkin,
Donnybrook, WA.

● *Thanks for your letter. Actually, the book reviews are written by EA staff members. The initials of the reviewer appear at the end of each review.*

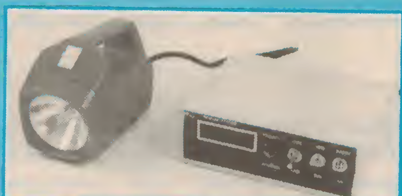
How many million in one billion?

I refer to your use of the word "billion". As no doubt you know, the English (and Australian) "billion" is 10^{12} or a bi-million, whereas the American (and French) billion is 10^9. One notices that the Commonwealth Bank, the Prime Minister and Treasury also use the word "billion" and this makes it impossible to determine which one is meant.

In the October edition of EA it is found at least twice (pages 7 and 17). I suggest that in a technical magazine, indices should be used to save confusion. After all, on page eight of the same magazine 11×20^{-18} occurred, leaving no room for confusion.

D. Lunck,
Clermont, Qld.

Digital Strobe



Covering the range from two to 200 flashes per second, this adjustable stroboscope is just the shot for measuring motor speed. It features a 4-digit LED readout and can be switched to display either revs per second or revs per minute.

100W VHF Amplifier

Here at last is a VHF linear amplifier that's easy to build. It features an output power of 100W and can be used with typical 10-15W transceivers such as the Dick Smith Commander published in June and July 1984.

Next month in Electronics Australia

Special Feature on AM Stereo

Interested in AM stereo for your car or lounge room? This special article looks at the equipment available and gives a complete listing of current stereo AM and FM radio stations.

CD Adaptor for Cars

How do you connect a portable compact disc player to your car sound system? With our CD Adaptor, of course. It's a simple circuit and easy to build. (Note: held over from last month.)

Note: Although these articles have been prepared for publication, circumstances may change the final content.

Editorial Viewpoint

by Leo Simpson

We've seen the last of cheap hifi!

During the preparation of this month's article on the second Australia hifi awards, one point became increasingly clear. Good hifi equipment is becoming increasingly expensive. This is in contrast to video cassette recorders which are now very cheap. At the time of writing this editorial, it was possible to buy a number of VHS machines at well under $500 and at least one Beta machine for less than $400, thought Beta machines are becoming quite scarce in the shops now.

Even the newer hifi VCRs have tended to steadily fall in price, or at least, not rise to reflect the falling value of the Australian dollar.

When compared with VCRs, hifi equipment is very dear. This is especially so when you compare the mechanical and electronic complexity of video machines with the relative simplicity of a stereo amplifier or even a fully synthesised AM/FM stereo receiver. For example, compare the prices of any of the 100W-plus amplifiers or receivers on page 8 and page 10 of this issue. Admittedly, these are mostly top-of-the-range models but they are dear, nonetheless. By contrast, the top performing Playmaster Series 200 amplifier is a real bargain.

Interestingly, the most complex piece of hifi equipment, the compact disc player, is steadily becoming cheaper in real terms.

Perhaps the main reason why VCRs and CD players are becoming cheaper is that they are being made in very large quantities whereas the production runs for hifi equipment are generally much smaller. There is also a certain amount of marketing "strategy" in the price of the esoteric hifi equipment but the general trend in prices is upward.

Of course, rack systems are still fairly cheap but unless you are thinking in terms of a system costing $1500 or more their performance is likely to be compromised, particularly as far as the loudspeakers are concerned. Loudspeakers, with their relatively high labour content, are the dearest hifi components of the lot and even quite modest two-way systems can now cost well in excess of $1000.

Luckily though, hifi equipment is still a buyers' market to some extent, so distributors and dealers will have to keep the lid on prices as much as possible to keep sales going. People who build their own amplifiers and loudspeakers will also have more incentive now, as they will be able to save even more money by working at their hobby.

Whatever happens, the era of cheap hifi equipment seems to have well and truly passed.

SOUND and

Before attempting to discuss at length the subject of high fidelity sound reproduction, it may be helpful to set out some basic facts about the nature of sound itself, the means by which we hear it and factors which determine whether or not we find the experience to our liking. So let's start right there.

Without resorting to the formality of a dictionary, sound may be defined broadly as anything that can be heard, whether it be in the form of noise, speech, music, or whatever.

Not everyone can hear every sound in a given environment because some sounds are so soft that, for certain people, they lie below their so-called "threshold of hearing". Again, other sounds may be too high-pitched for some people's ears to sense.

In the normal way, sound is created when a vibrating mechanical body or other such disturbance produces a sequence of rapidly recurrent variations in air pressure in its immediate vicinity. The variations radiate outwards from the source, through the surrounding air in the form of sound pressure waves, much like ripples in a pond.

On reaching a person's ears, the recurrent pressure waves are sensed by means we shall examine a little later. Transformed into neural (nerve) impluses, they then pass to the brain, where they are interpreted as "information" of one kind or another: noise, speech, &c.

Fig.1 illustrates the simplest, purest tone that can be presented to the human ear — a "sine" wave, so called because it has a mathematical basis. Sine waves, or something very similar to them, are produced by electronic organs and music synthesisers and are employed in audio test equipment.

Some traditional music sounds, and the associated air pressure variations, are relatively simple, for example, single notes from a solo flute; others are extremely complex, like those from an orchestra, a concert organ or a large choir.

The amazing thing is that, simple or complex, the human brain is able to sort out pressure variations sensed by the ear and translate them into something we can relate to or, alternatively, ignore!

How many times have you been absorbed in a book and apparently not heard sound that must clearly have reached your ears? Or conversely, been asleep and ostensibly unaware of any sound — except one that your "sleeping brain" considered important enough to let through?

Sound pressure level

Sound pressure level (SPL) can be expressed in microbars, reminiscent of the millibars used to specify atmospheric pressure in weather reports. In the context of audio-hifi, however, sound pressure level is commonly expressed nowadays in dynes/sq.cm, a unit that is quantitatively equivalent to the microbar.

The smallest sound pressure level that can be sensed by young, healthy human ears — the so-called threshold of human hearing — is about 0.0002 microbar. By comparison, a person talking generates a sound pressure level of around 1 to 2 microbars, at a distance of 1 metre, and up to 10 microbars when shouting.

Typical human ears can cope with sound pressure levels up to about 200 microbars without obvious aural overload. At pressures approaching and beyond 2000 microbars, however, sounds become physically painful and may damage the hearing with prolonged exposure.

Many old-time boilermarkers learned this the hard way!

Meet the decibel

While the foregoing figures are informative, they are also rather clumsy and they take no account of one very important fact: that the ear varies its sensitivity automatically as the prevailing level of sound rises or falls. It transpires that the loudness of sound, as perceived, varies approximately as the logarithm of the change in acoustic power level.

It is because of this characteristic that the ear can cope with such an enormous range of sound pressure levels — from the barely audible hum of a mosquito in a quiet room to the massive roar of a jetplane at take-off.

WAVES... how we hear them

by NEVILLE WILLIAMS

The "decibel", a logarithmically based unit, was adopted many years ago by the audio-acoustics industry, as a more eloquent way to express relative power levels, especially as they affect people needing to quantify original or reproduced sound on an everyday basis.

A power ratio can be converted to decibles (dB) by determining the log (to the base 10) of the particular ratio, multiplying it by 10 and calling the result decibels (dB).

Since the acoustic power of a sound varies as the square of the sound pressure level, the log of the pressure ratio has to be multiplied by 20, rather than by 10. A pressure ratio of 10:1 works out at 20dB, 100:1 at 40dB, 1000:1 at 60dB and so on.

Research has shown that the smallest change in sound pressure level (SPL) that human ears can easily detect is about 3dB, equal to a power ratio of 2:1. It may come as a surprise to realise that doubling the acoustic power of a sound, or the available power output from an amplifier, makes only a marginal difference to the perceived loudness!

Decibel notation was subsequently adapted by the industry to express absolute sound pressure levels, as distinct from mere ratios, by arbitrarily referencing 0dB to the nominal threshold of hearing at 0.0002 microbar.

This provides the basis for Table 1, and many others like it, showing 0dB as the threshold of hearing, 40dB as the ambient sound level in a typical living room, 60dB as an average conversational level and 140dB as the pain threshold.

Amplitude, frequency

The magnitude of the upward/downward excursions in instantaneous pressure is referred to as the "amplitude" of a sound wave — miniscule for tiny sounds, just the reverse for jet planes. Fig.1b depicts the peak-to-peak amplitude of a sound pressure wave, and the RMS value on which the acoustic power is based.

(Amplitude is a term that is encountered frequently in audio/hifi literature, being used to describe the magnitude of signals passing through an audio amplifer, the physical movement of loudspeaker cones and so on.)

Sound waves travel through normal atmosphere at about 335 metres (1100ft) per second, much slower than radio waves (or light waves) at around 300,000km/s.

For a sine wave or a simple tone propagating through air, a complete pressure excursion from normal to maximum, then through to minimum and back to normal is referred to as one "cycle" (Fig.1b).

The number of complete cycles passing a given point in space in one second is described as the "frequency" of the signal.

Audio frequencies were originally specified in cycles per second (c/s) or kilocycles per second (kc/s). In honour of the pioneer German physicist, Heinrich Hertz (1857-1894) c/s was subsequently replaced by the term "Hertz" (Hz) along with its decimal multipliers, kHz, MHz, &c.

The distance between adjacent pressure peaks is defined as the "wavelength" (Fig.1a). Without dwelling on the matter here, the wavelength of sound energy has an important bearing on its behaviour in a domestic hifi situation, especially in regard to loudspeakers and listening room dimensions.

Sense of hearing

So much for the nature of sound. Before pursuing it further into the everyday world of music, speech and noise, let's take a closer look at human hearing — undoubtedly a most discriminating faculty.

At its best, the ear can cope with a tremendous range of sound pressures, and sense frequencies from about 15Hz to almost 20kHz. It can readily pick the difference between various instruments playing the same note and sort out the instrumental sounds in a complete orchestra. It can detect changes in pitch of 1 part in 1000, and nominate the direction from which sounds are coming.

A blindfolded person can even form a judgment of an acoustic environment by spontaneously sensing the direction and time delay of echoes.

While human hearing certainly does deteriorate with age and as a result of illness, it nevertheless justifies the considerable effort put into the initial creation of good music and the provision of

Sound Pressure microbars	Typical Sound	Loudness Level decibels
2000	pain threshold	140
200	jet aircraft	120
20	subway	100
2	orchestra	80
0.2	conversation	60
0.02	quiet room	40
0.002	rustling leaves	20
0.002	hearing threshold	0

Table 1: Typical listening situations listed against measured sound pressure levels (left) in microbars, and subjective loudness level (right) expressed in decibels.

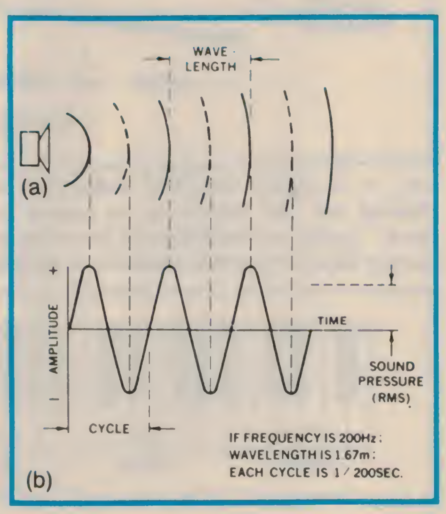


Fig. 1: Depicting a sine wave (b) as radiated from a loudspeaker (a). The diagram illustrates various parameters mentioned in the text: cycle, wavelength, frequency, amplitude and sound pressure level.

Sound waves–how we hear them

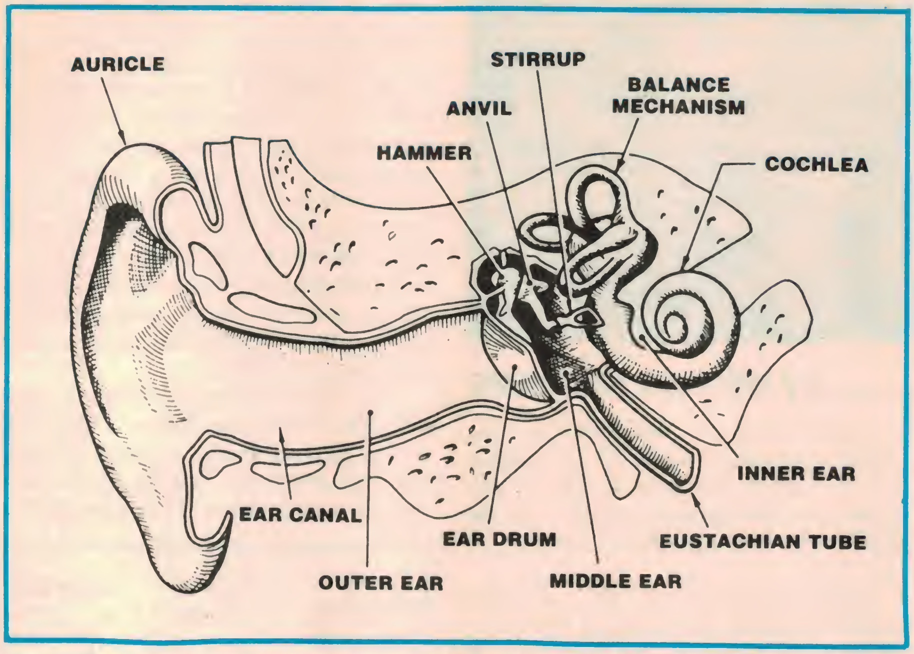


Fig. 2: The human ear comprises three main sections: (1) the outer ear — auricle, ear canal and drum; (2) middle ear — three tiny bones which control the sound vibrations on their way to (3) the inner ear or cochlea — virtually nature's "microphone". Note that the inner ear is also involved in maintaining our sense of balance.

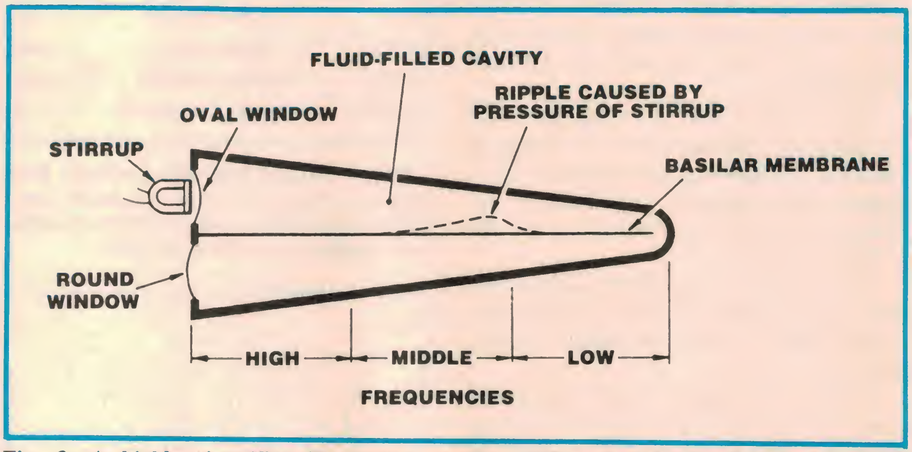


Fig. 3: A highly simplified illustration of the cochlea. Sound vibrations originating through the oval window set up pressure waves in the cochlea fluid, causing "standing wave" ripples or oscillations to be set up in the basilar membrane. Their position is frequency dependent and is sensed by a complex of nerves.

equipment able to record and reproduce it faithfully.

The human ear

The human ear comprises three distinct sections: the outer ear, middle ear and inner ear. The outer ear involves the visible fleshy part, called the auricle or pinna, plus the ear canal and ear drum, as illustrated in Fig.2.

Recent work has confirmed that the auricle or pinna are not just random adornments or nature's fortuitous provision for supporting spectacles! They modify the incoming sound waves in a way which contributes significantly to the ability of the ear to sense direction.

The ear canal is a fleshy tube, open at one end, which functions vaguely like an organ pipe, in exhibiting a modest degree of resonance. It favours incoming sound waves in the region between about 2000 and 5000Hz, tending to increase acuity in the important upper-mid frequency range.

At the inner end of the ear canal is a tough, flexible membrane called the ear drum, which seals and separates the outer ear from the middle ear.

The middle ear

The ear drum vibrates in sympathy with the air column in the ear canal and transfers the vibrations to three tiny bones in the middle ear. Called the hammer, anvil and stirrup (or stapes) the three bones form a lever system which passes the vibrations on to the inner ear, at the same time providing a measure of impedance matching between the two.

A system of involuntary muscles controlled from the inner ear acts as a form of automatic volume control to protect this delicate system from damage. When excessively loud sounds are encountered, the muscles readjust the position of the bones slightly and tighten the ear

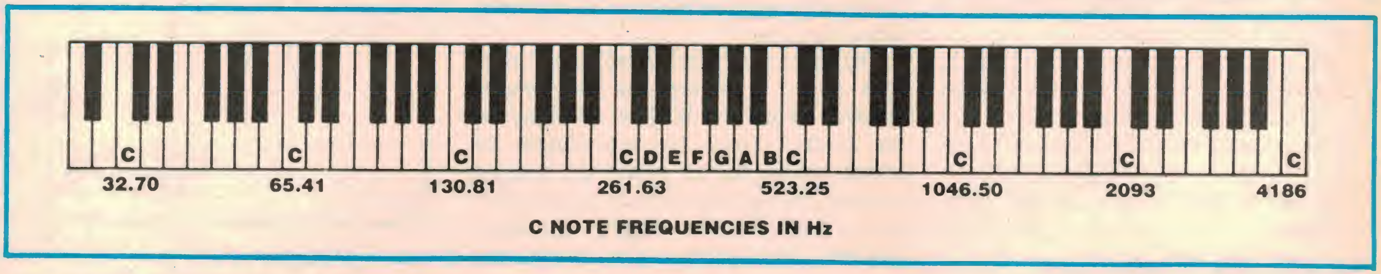


Fig. 4: If you are uncertain about the relationship between frequencies in Hertz and the actual pitch of musical notes, this diagram should help. For standard concert pitch, middle-C has a frequency of 261.631Hz. Note that the frequency of each semitone increases by a factor of about 1.06.

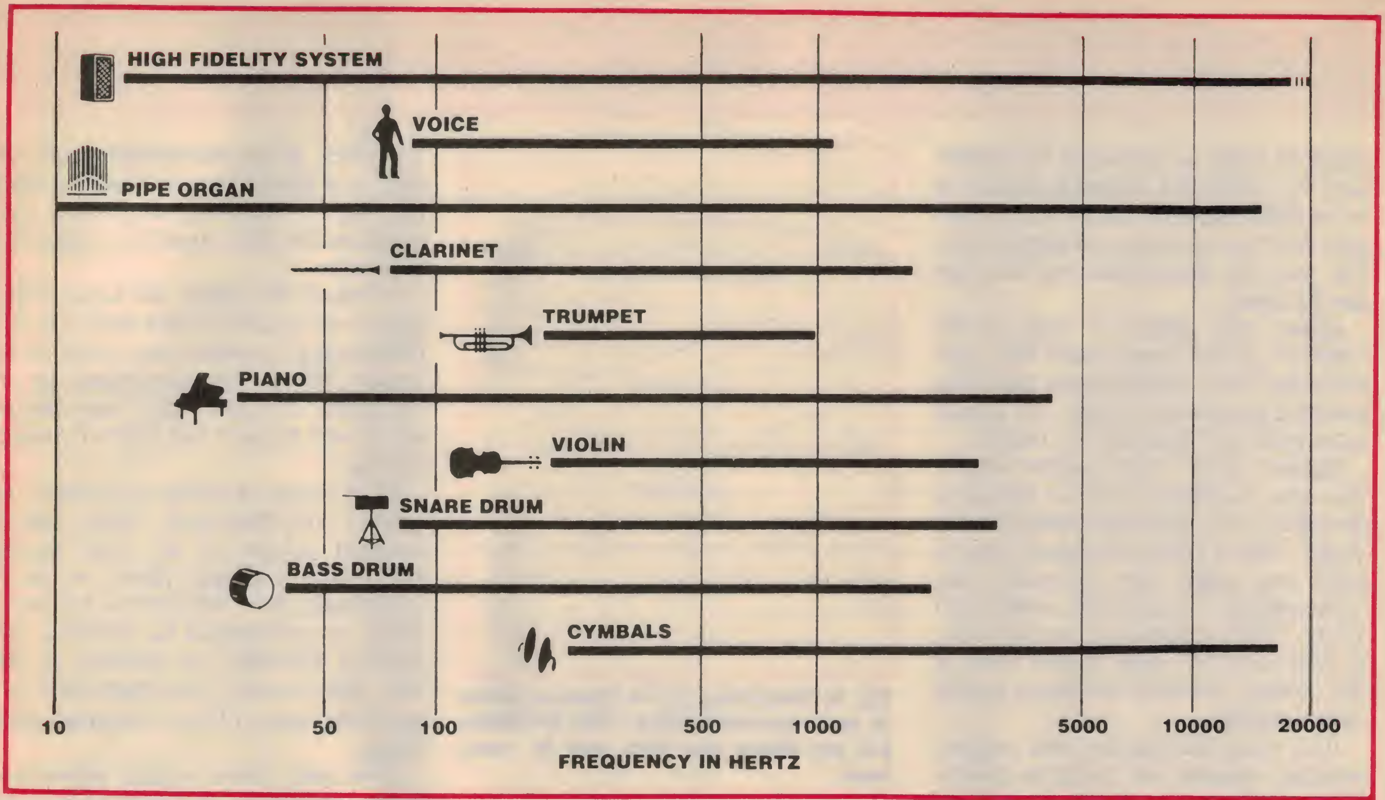


Fig. 5: Musical instruments would be a dull lot if the only frequencies they could produce were within the confines of their formal music range. In fact, their sound is enriched by an array of harmonics, plus other subtle non-harmonic sounds.

drum so that less of the vibration energy gets through to the inner ear.

While the provision is effective in most ordinary situations, it does little to protect the ear against continued long-term exposure to excessive noise levels, or against sudden, explosive blasts of sound.

One other point should be made here, which will be better appreciated as we get further into the series: the automatic volume control function of the ear appears to operate at a sub-audio rate. Thus, while it can adjust the sensitivity to accommodate a variety of prevailing sound levels, the logarithmic control characteristic does not greatly affect the shape of individual audio waveforms.

It therefore does not produce gross aural distortion, as is sometimes suggested. In this respect, the control characteristic of the ear finds a parallel in a variety of variable gain electronic circuits.

The inner ear

As illustrated in Fig.3, sound vibrations are transferred by the stirrup of the middle ear to what is effectively a second diaphragm — the so-called "oval window" of the fluid-filled cochlea.

To-and-fro vibration of the oval window causes waves of fluid pressure to sweep the length of the snail-shaped cochlea, creating "standing wave" ripples in the (basilar) membrane. These, in turn, are sensed by an intricate system of nerves.

Ripples occur at different points along the membrane, depending on the frequency of the incoming sound wave(s) and only nerves which are near the crest are stimulated, thus accounting for the ear's ability to sense frequency.

The inner ear is the "microphone" of the hearing mechanism, in the sense that it converts sound vibrations into neural signals. There the comparison lapses, however, because nerves by their very nature deal in pulse-type information rather than a smooth, electrical replica or analog of the sound envelope.

The fact that the brain can interpret a pattern of sound as complex as that from a full symphony orchestra, plus a choir and/or a grand organ, becomes all the more amazing when it is realised that, in the process, the information has been neurologically pulse-encoded and decoded!

A subjective skill

Most people are born with the potential to hear and interpret sound but the actual ability to do so has to be learned by experience, from birth. Like any other learning process, it is subject to a variety of factors, both physical and environmental.

As already suggested, some people's ears are able to sense a wider range of frequencies than others, but the ability can be curtailed by age, physical ailments, or prolonged exposure to excessive levels of sound — a hazard that has been historically greater for men than women.

To complicate matters further, hearing loss can affect one ear more than the other, causing a degree of unbalance which the brain may not be able to compensate. When this occurs, the ability to sense the direction of sound is impaired, along with the facility to concentrate on a particular sound in a noisy environment. It becomes more difficult, for example, to follow a conversation in a crowded room.

People differ also in their ability to tolerate high levels of sound, with the advantage, this time, appearing to favour men. Certainly, most complaints about music being excessively loud, to the point of physical distress, seem to come from women.

But men and women alike tend to condemn most readily, as too loud, sound which they happen not to like, indicating something other than a purely physical reaction.

Certainly, the "loudness" of speech or

Sound waves–how we hear them

music or noise, as perceived by individuals, is a subjective judgment and needs to be distinguished from the sound pressure level as measured on instruments. The two are interrelated but they are not the same.

Again, ears appear to vary in the "quality" of the signal which they pass on to the brain. Musical tones which are accepted as normal by some, are judged to be harsh or "distorted" by others.

Musical "pitch" is yet another subjective area, as distinct from the measured frequency of a particular musical note. People with a highly developed sense of pitch may argue that, frequency notwithstanding, a certain note sounds "off pitch". Their judgment, it would seem, is influenced by other factors such as the relative loudness and tonal quality of the sound.

It is often unclear, in such matters, whether opinions are based on physiological differences or acquired skills, or both, but one thing is certain: Our reaction to sound is individual and subjective; we each hear things a little differently from our neighbour — a fact which undoubtedly enlivens debate about audio-hifi topics!

And so to music:

It was stated earlier that young, healthy human ears can typically sense frequencies from about 15Hz to just under 20kHz. To convey some idea of what various frequencies sound like, Fig.4 shows the frequency of various C notes on a piano (or on an organ using what is described as an "8ft" voice).

Fig.5 depicts the nominal frequency range of various well known instruments, and here a word of explanation:

If the frequency scale along the bottom of the diagram looks strange, it is because it conforms to the normal practice of plotting audio frequencies on a logarithmic scale. It opens up the important bass region and puts the middle or voice frequencies in the centre, without unduly crowding the treble end.

For instruments which produce discrete musical notes (e.g. organ, clarinet, trumpet, piano & violin) the frequency range depicted in Fig.5 refers purely to what is known as the "fundamental" or "first harmonic", or the basic musical pitch of the physically available notes. Those on the piano keyboard cover a freqency range from just under 30Hz to something over 4000Hz (or 4kHz).

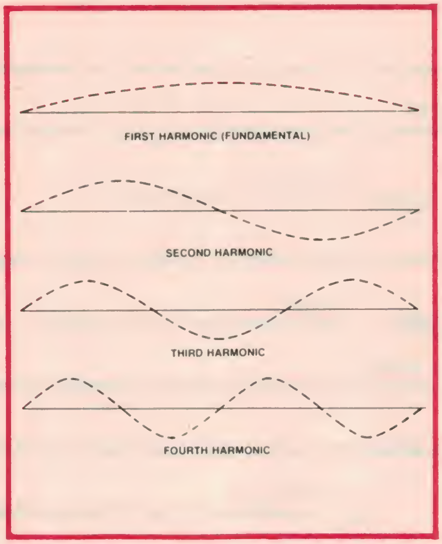


Fig. 6: Illustrating typical vibration modes of an instrumental string. Only harmonics 1-4 are shown but there can be many more.

Harmonic modes

There is more to it, however. When strings are struck (as in a piano), plucked (as in a guitar) or otherwise excited (as in the violin family) they tend to vibrate in a quite complex manner, as illustrated in Fig.6.

In the fundamental (or first harmonic) mode, the string vibrates or oscillates as a whole with respect to the two fixed ends — this at a frequency determined mainly by its physical mass and the tension to which it is subjected. In so doing, strings generate sound waves at the fundamental frequency: 261.63Hz in the case of middle-C.

But there is also a tendency for the two halves to oscillate simultaneously around the centre point, producing a "second harmonic" at about twice the frequency of the fundamental note. A third and fourth harmonic mode is also illustrated in Fig.6 but, in practice, harmonic modes may extend to at least the eleventh.

It follows that, while the nominal frequency of middle-C is 261.63Hz, the accompanying harmonics may range up to around 3000Hz. For notes higher up on the piano keyboard, they may extend up to and beyond the limit of human hearing.

What is true of strings is also true, in general, of instruments relying on a resonant column of air (pipe organ, flute, &c), resonant plates or tubes (xylophone, &c), resonant reeds (accordion), or reed-excited air columns. All produce harmonics in addition to the first, and therefore frequencies well beyond the limits of their nominal pitch range.

Over and above regular harmonics, many instruments are characterised by subtle non-harmonic noises of their own: the air noise of a pipe organ or flute; the thud of hammers or the click of plectra; the buzz of reeds; the scrape of bows — noises which can be acceptable or objectionable, depending on the merits of the instrument and the player.

Memorised, over the years, these harmonics and sounds provide the basis on which we recognise the various instruments — along with members of the percussion family: the bass drum, the timpani, snare drum, cymbals, triangle and the rest.

Wave "envelope"

Out of all this, certain puzzling but quite legitimate questions may occur to the reader:

Considering just one typical note from one typical instrument, with a dozen different frequencies present, plus those

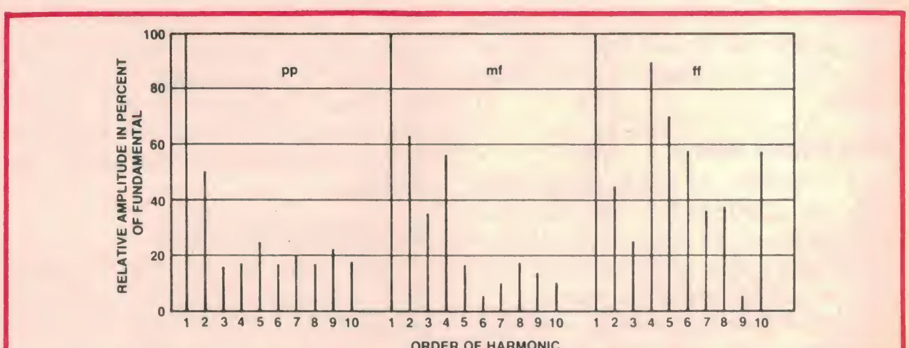


Fig.7: Harmonic analysis of middle C played on a piano at three loudness levels.

"subtle non-harmonic noises" . . .

How can one's ear drum follow a dozen or more frequencies simultaneously? How can it be doing a dozen or more things at the one time? And how can it possibly respond to fifty-dozen frequencies simultaneously from an orchestra or a choir?

The short answer is that ear drums cannot follow a multitude of frequencies simultaneously, or be moving in several different directions at once. Nor do they need to — fortunately!

While an instrument may indeed be producing many frequencies simultaneously, at any given instant, at a single point in space, the individual sound pressure waves can only add up to a single pressure resultant.

At the next instant — and the next — the resultant may be static, or increasing or decreasing; it can't be doing more than one thing at one time. So, if your ear drum happens to be at that reference point, it will simply be responding to the instantaneous resultant — frequently described as the sound pressure "envelope".

Fig.8 shows typical sound pressure resultants or "envelopes" from a violin, trumpet and clarinet, plus one from random noise. The amazing fact is that, if presented with such a sound envelope, the human brain can discern the component frequencies and identify them with a particular instrument; or as just plain noise!

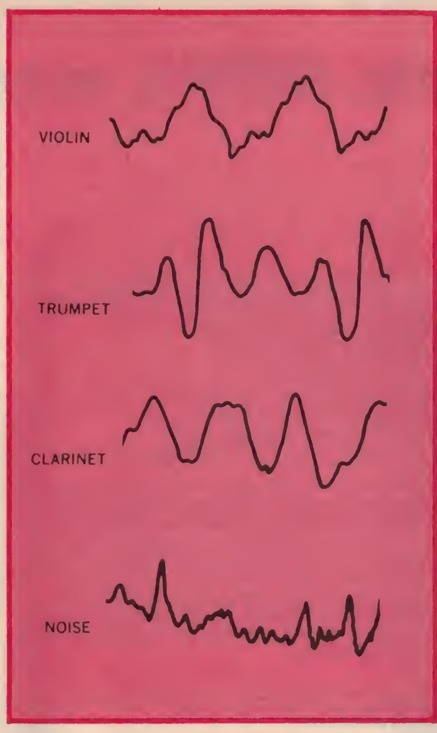


Fig. 8: Typical waveforms that might be presented to the ear, either directly or from a loudspeaker. Although just a scrawl to the eye, they can be resolved by our hearing into frequency components characteristic of the source.

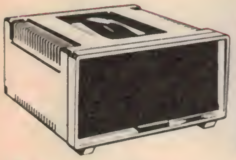
And even if the envelope is that instantaneous pressure resultant from a complete symphony orchestra, with or without an associated choir or orchestra, plus building reverberation, the brain can still sort it out!

Fortunately, for the audio-hifi industry, the introduction of a recording and amplifier chain does not upset things. The microphones translate a pressure envelope into an electrical envelope or resultant, which is then recorded, reproduced, amplified and transformed back into a pressure envelope by the loudspeakers.

If the shape of the sound pressure envelope survives the procedure without being unduly degraded, we can enjoy performances by the greatest artists and the greatest orchestras in the world — some of them no longer with us.

But, for that to be the case, it is essential that the entire recording, reproducing and amplifying chain be as near to perfect as technology and finances will allow. And, really, that's what high fidelity is all about!

Did you know... Rod Irving Electronics have over 7,000 line items?!



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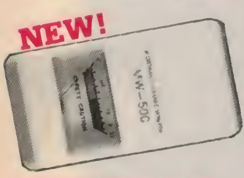

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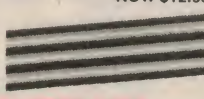

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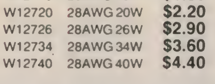

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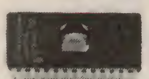

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2764	$6.25	$5.95	$5.00
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6116	$2.95	$2.75	$2.50
41256	$7.00	$6.50	$6.00
6264	$6.50	$5.50	$5.25

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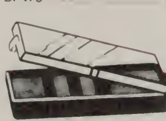
MPSA93	$0.25
MJ15004	$2.90
2N4033	$0.30
2N3055	$0.80
2N3772	$2.90
2N3773	$2.90
FND507	$1.00
6845	$6.00
MJ802	$2.90
BF469	$0.40
BF470	$0.40



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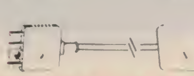
Electro static charge proof plastic IC case with conductive sponge
Dimensions 75 x 130 x 19mm

Cat H10095 **$5.95**



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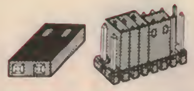

MINI JUMPERS

- Contact terminal: Phospor bronze
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- Gold plated

Qty	Cat. No.	Price
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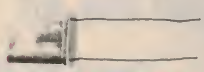

CRYSTALS SPECIALS

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Description	Cat.No.	1-9	10+
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1.8432MHz	Y11003	$7.50	$6.50
4MHz	Y11020	$2.50	$2.00
4.194304MHz	Y11022	$2.50	$2.00
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4.75MHz	Y11025	$2.50	$2.00
4.915200MHz	Y11026	$2.50	$2.00
5MHz	Y11030	$2.50	$2.00
6MHz	Y11040	$2.50	$2.00
6.144MHz	Y11042	$2.50	$2.00
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8MHz	Y11050	$2.50	$2.00
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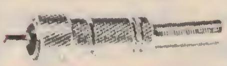
10MHz	Y11060	$2.50	$2.00
12MHz	Y11070	$2.50	$2.00
14.31818MHz	Y11072	$2.50	$2.00
15MHz	Y11075	$2.50	$2.00
18MHz	Y11082	$2.50	$2.00
18.432MHz	Y11085	$2.50	$2.00
20MHz	Y11090	$2.50	$2.00



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Plug Cat. P10151 **$2.95**
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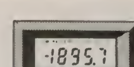

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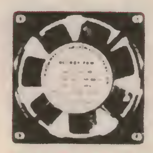
SPECIFICATIONS:
Accuracy: 0.01 m ± 1 digit
Linearity: ± 1 digit
Samples/sec: 1.6
Temp. Stability: 50 ppm/°C typical
Temp. Range: 0 - 35°C
Supply Voltage: 7.5 - 15V
Supply Current: 1mA typically
Max DC Input Voltage: + - 20V

Cat Q15520 **$99.95**



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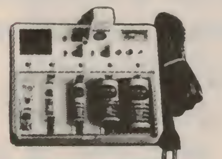
115V 3½" Cat T12467 **$12.95**
10 Fans (mixed) less 10%



UNIVERSAL BATTERY CHARGER AND TESTER

Save money on expensive batteries with this universal battery charger. Features include meter tester, and provisions for D, C, AA, AAA, N, button and cell batteries, 9V and 6V (square types). Comes complete with detailed instructions

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- Includes Nicad battery
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Cat S15031 12V 2.6 AH **$39.50**
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Dimensions: 490(W)x145(H)x400(D)

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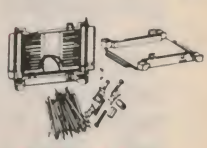
SciSys computer chess games are endorsed by Garry Kasparov, world's highest rated chess player, and are available from Rod Irving Electronics!

TURBO 16K

This brand new chess computer sets new standards in user convenience, and beats 92% of all chess players with its powerful 16K program.
Features:
Instant response
- Solves mate in 10 moves
- Internal clock with 2 LCD displays
- Displays moves considered
- Thinks in opponent's time
- Takes back
- 17 Levels
- 2 Year memory
- Mains adaptor socket

Cat. C30010 **$295**



RS232 MINI PATCH BOX

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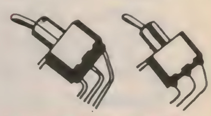
- With male to female 25 pin inputs
- 25 leads with tinned end supplied
- Complete with instructions

Cat X15654 **$25.95**



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Errors and Omissions Excepted

Philips CD555 portable music system

Well, at last it has happened. There is now a "CD ghetto-blaster". Philips' CD555 machine incorporates a compact disc player, auto-reverse cassette deck, FM stereo with multi-band AM tuner, five-band graphic equaliser and a 14W per channel stereo amplifier. In short, it's got the lot.

Ghetto-blasters are ubiquitous. Seen and heard everywhere, they are the 80's equivalent of the old 5-valve mantel radio. Most of them offer fairly ordinary performance in a fancy-looking package. Now Philips has changed the name of the game by releasing a machine with a CD player inside.

This means that it now has a machine potentially capable of very good performance, at least from the CD player side. But is it any good?

In appearance, the new Philips CD555 is certainly an impressive machine with its compact size, LCD readouts, numerous slider and pushbutton controls plus large compact disc and cassette loading doors.

Overall size of the player itself is 320 x 220 x 230mm (W x H x D), while the detachable loudspeakers measure 175 x 220 x 210mm. The handsome colour scheme consists mainly of a metallic grey finish on the case which highlights all the silver control buttons.

At the top left hand side of the control panel are the on/off switch and the slider controls for the five-band equaliser. These have a maximum of 10dB boost and cut centred on 63Hz, 250Hz, 4kHz and 16kHz. Two further sliders are provided for the microphone input level and balance controls.

At the top right hand side are the coarse and fine tuning knobs for the FM and AM medium and shortwave bands, while below the tuning dial are the band selection and mode selection pushbuttons.

At the lower right hand side are located the sockets for a pair of stereo headphones and a microphone. The remaining pushbuttons on the lower portion of the front panel are for the cassette and CD player functions.

Compact Disc Player

The CD player has vertical front disc loading, and pressing the Eject button opens the compartment door to accept a compact disc. When the drawer is closed by hand, the number of tracks on the disc is indicated on the liquid crystal display.

Controls are provided to include programming and repeat, audible fast forward and reverse, and previous next track selections. A Time/Track switch selects whether the display shows the elapsed time for each track or the track and index number. When displaying time, the word "Time" is indicated on the display.

Other display indications are "Pause" and "Error" which occur whenever the Pause switch is pressed and whenever a

fault, such as no disc in the mechanism, occurs.

Cassette Player

The auto-reverse cassette player has similar play and programming functions to the CD player, and these are indicated by the liquid crystal display when selected. The auto-reverse mechanism is very nifty, with the record/play and erase head assembly rotating very smartly and snapping into place whenever a change in tape direction is called for.

The machine also incorporates automatic sensing so that there is no need for tape type selection buttons. Naturally, as you would expect from any machine which had any pretension to quality, the CD555 includes Dolby noise reduction.

Recording modes

Three recording modes are provided. Normally, the "Record" button is used to record from all sources except for compact disc. CD recordings are made using the "Record/Mode" instead of the "Record" switch. It has two functions; when pressed once, the cassette player and CD player are synchronised so that the recorder is controlled by actuating the CD player keys.

Pressing the Record/Mode switch twice gives a four second quiet passage between each recorded track. These pauses are necessary if the player is to discern between tracks when track order programming is used on playback.

Loudspeakers

The loudspeakers for the CD555 can be clipped on or detached from the player unit. Each consists of a fully-sealed particle board enclosure with a fancy plastic grille plate. Behind this is a 40mm cone tweeter and a small woofer with a roll surround and an effective cone diameter of about 95mm.

Naturally, the system will sound better with higher quality external speakers but these small units sound quite pleasant.

Performance

We were particularly interested to measure the performance of the compact disc player to see if it was as good as other players from the Philips stable. We measured the performance via the line outputs of the machine.

Frequency response was very flat across the audio band and was only 0.25dB down at 18kHz and 0.5dB down at 20kHz. Distortion was .0045% down at 20Hz and then rose gradually to .008% at 1kHz.

Linearity was very good down to a level of −70dB. At −80dB the error was 2dB and at −90dB there was a 5dB error, mainly due to the residual noise. The signal-to-noise ratio was 90dB. Separation between channels ranged from −80dB at 100Hz to −60dB at 10kHz and 20kHz.

We checked the tracking performance of the CD555 using the Philips NR4A test disc. This has a simulated fingerprint, artificial dirt spots and interruptions in the information layer. As is typical of the better-performing compact disc players, the CD555 managed to play through all of the disc without an audible hiccup.

The machine also appears to be quite immune to heavy vibration and knocks to the cabinet which is really a mandatory requirement for a portable player.

All the above results clearly show that Philips have not compromised the CD performance of this machine at all. It is every bit as good as a normal CD player deck and could easily double as a CD deck connected to the home hifi system.

Brief tests of the power amplifiers showed that they could deliver 18 watts into 4Ω loads with one channel driven at 1kHz. With both channels driven, it produced 14 watts into 4Ω loads. Distortion at 1W and 1kHz was measured at 0.2%.

We did not spend much time assessing the FM and AM tuners as we understand that the production machines to be sold in Australia would be different from our sample prototype, particularly for the AM bands. However, the prototype did give quite acceptable performance on FM stations and the AM performance was usable even if it was in mono and of narrow bandwidth.

Both the CD and tape player provided excellent sound quality on headphones and a good clean sound with the loudspeakers.

For those who want a comprehensive portable music system which includes a compact disc player, the Philips CD555 is a very attractive machine. Recommended retail price is $899. The machine should be widely available from department stores by the time this review appears. (J.C.)

Track down hidden transmitters

Build this radio direction finder

Want to find out where a radio signal is coming from? Or locate the source of an illegal transmitter? The radio direction finder described here will track it down using an electronically rotated antenna.

by GREG SWAIN

Physically, the radio direction finder consists of two separate units. One contains the control and display electronics and is located adjacent to an FM transceiver or receiver; the other is a special antenna switching unit (ASU) which is connected to the control unit via a 4-way cable.

An electronic "compass" display consisting of 32 LEDs indicates the transmitter bearing. When a signal is received, its relative bearing to the antenna system is indicated by whichever of the 32 LEDs illuminates.

In fixed installations, this allows the compass bearing of the signal to be directly indicated to within ±5.6 degrees. When installed in a car, successive readings allow you to pinpoint the exact location of the transmitter.

As such, the Dick Smith Radio Direction Finder (or RDF for short) is just the ticket for tracking down illegal transmitters and anti-social radio operators. Depending on the antenna system, it can operate on any band within the range 50-500MHz and will work with FM receivers ranging from pocket scanners to amateur radio and CB transceivers.

Radio direction finders of this type can cost around $600 or more, but this unit can be built for just $139. It was developed at Dick Smith Electronics and is available as a complete kit of

The relative bearing of the transmitter is indicated on a 32-LED compass rose.

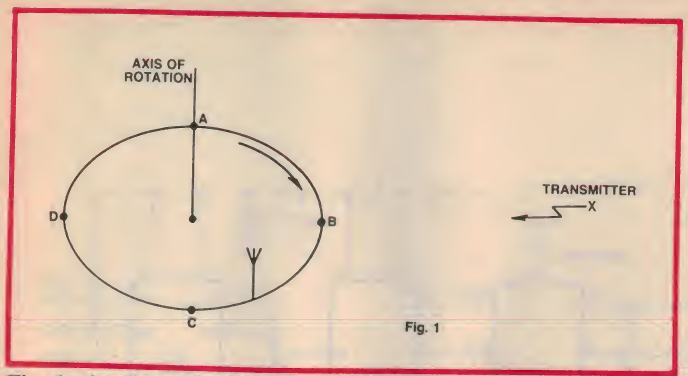


Fig. 1: signals received by an antenna mounted on the edge of a rotating disc are frequency modulated due to the Doppler effect.

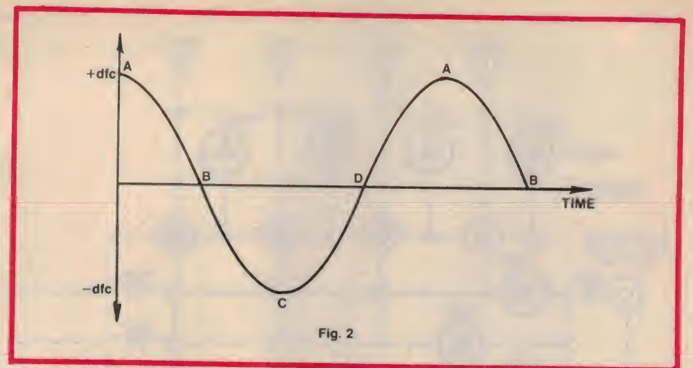


Fig. 2: this graph illustrates the frequency shift as the antenna moves towards and away from the transmitter.

parts. We think it will be especially popular with amateur radio operators.

How it works

The theory of operation is reasonably simple. Radio signals received on a rapidly moving antenna undergo a frequency shift due to the Doppler effect, an effect well known to anyone who has observed a moving car with its horn blowing.

Consider a single antenna mounted on the edge of a rapidly spinning disc. As the antenna moves towards the source of the RF carrier, the apparent frequency will increase due to the Doppler effect. Conversely, as the antenna moves away, the frequency will decrease.

Thus, the rotating antenna causes frequency modulation of the received carrier. When this type of antenna is connected to an FM receiver (the type most often used on 2 metres), a tone is heard.

By analysing the phase of this tone, the direction of the transmitter can be determined.

To avoid the obvious drawback of a mechanically rotated system, the Dick Smith RDF simulates a rotating antenna electronically. Four vertical whip antennas are arranged around a circle of diameter .07-0.4 wavelengths. These are electronically switched clockwise in sequence such that all four antennas are scanned once every 1/1250th of a second.

This situation is equivalent to one vertical antenna mounted on the perimeter of a disc spinning at 1250 revolutions per second. For a diameter of say 800mm (for the 2-metre band), this results in a tangential velocity of 3140 metres per second.

The deviation of the received carrier is determined as follows. For $V << C$, we can neglect relativistic effects and write:

$$Fr/Ft = 1 - V/C$$
$$\text{also } dF = |Fr - Ft|$$
$$\text{therefore } dF = Ft \times V/C$$

where Fr is the received frequency, Ft is the transmitter frequency, dF is the frequency shift, C is the velocity of light (3×10^8 m/s) and V is the antenna velocity.

For V = 3140 m/s and Ft = 144MHz, the carrier will deviate 1.5kHz at a rate of 1250Hz. For lower carrier frequencies, the deviation will be proportionally lower.

Note, however, that the 1250Hz modulating tone remains constant as it is a function of the antenna switching rate only.

The output from the FM receiver is applied to the signal input of the RDF adapter and compared with an internal reference phase. The resultant phase angle appears as a 5-bit binary code and this is decoded to a one-of-32 output to drive the appropriate indicator LED.

In addition, the detected audio tone can be monitored on an internal loudspeaker. This provides audible indication that the receiver is correctly tuned to the transmitter frequency.

The circuit

Antenna switching is accomplished by first deriving a 2-bit binary code from a 1MHz master oscillator. Here's how it's done:

Inverter stages IC2a, b & c (4069) form the 1MHz oscillator with buffering provided by IC2d. This clocks decade counters IC4 and IC7, both of which divide by five to produce a 40kHz signal on pin 1 (CK) of IC10.

IC10 is a 4024 7-stage binary counter. Its Q1-Q5 outputs directly drive the D1-D5 inputs of IC12, a 40174 hex latch, while Q4 and Q5 also drive IC9 which is a 4555 one-of-four decoder.

What happens is that IC9 accepts a 2-bit binary code from IC10 and provides the quadrature antenna switching signals. These signals are interfaced by a 1488 line driver (IC6). The outputs of IC6 swing positive and negative in sequence to provide bias for the matrix diodes (D201-D208) in the antenna switching unit (ASU).

The diode matrix is arranged so that, at any given instant, three of the antennas are effectively shorted and only one is coupled to the receiver. For example, when pin 11 of IC6 is low (−9V), D205-D207 are forward biased and short out antennas 2 to 4.

At the same time, D201 will also be forward biased while D202-D204 are turned off. Antenna 1 will thus be connected to the receiver.

The detected audio tone from the FM receiver is applied to the input of the RDF adapter, limited by D1 and D2, and filtered by a single-pole active lowpass filter stage (IC5). This chip is described by National Semiconductor as an MF5 Universal Monolithic Switched Capacitor Filter. Basically, it is a general purpose active filter building block.

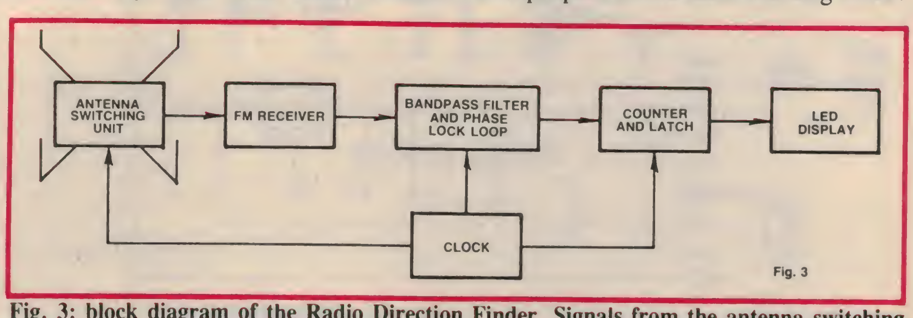
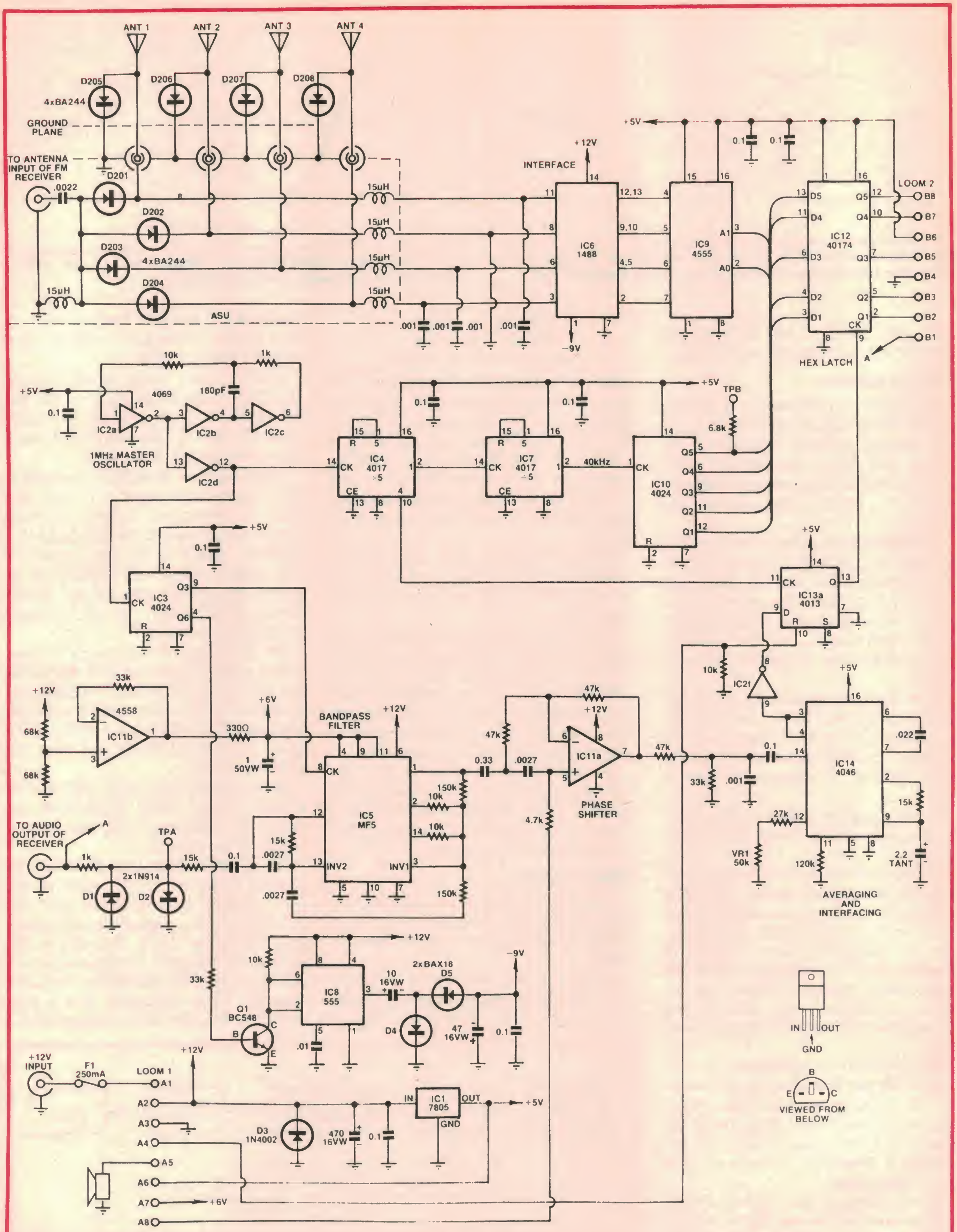
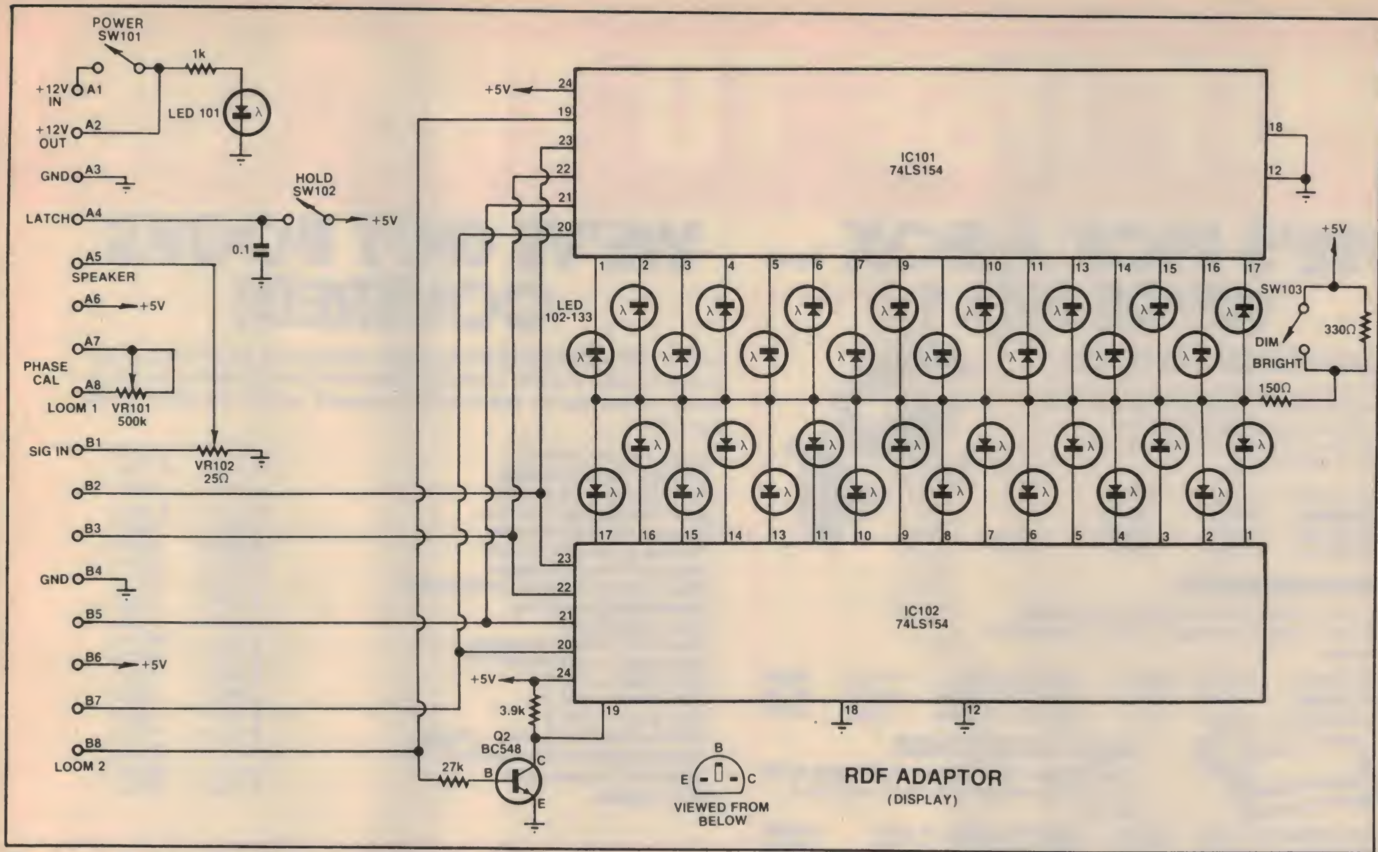


Fig. 3: block diagram of the Radio Direction Finder. Signals from the antenna switching unit are fed to an FM receiver and the output compared to a reference phase.


ANT 1
ANT 2
ANT 3
ANT 4
D205
D206
D207
D208
4xBA244
GROUND PLANE
TO ANTENNA INPUT OF FM RECEIVER
.0022
D201
D202
D203
4xBA244
D204
15μH
ASU
.001
INTERFACE
+12V
IC6
1488
-9V
IC9
4555
+5V
0.1
IC12
40174
HEX LATCH
LOOM 2
B8
B7
B6
B5
B4
B3
B2
B1
10k
1k
4069
180pF
IC2a
IC2b
IC2c
IC2d
1MHz MASTER OSCILLATOR
IC4
4017
÷5
IC7
4017
÷5
40kHz
IC10
4024
TPB
6.8k
IC3
4024
IC13a
4013
33k
4558
+12V
68k
IC11b
330Ω
+6V
1
50VW
BANDPASS FILTER
IC5
MF5
150k
15k
.0027
0.33
47k
IC11a
PHASE SHIFTER
4.7k
IC2f
IC14
4046
.022
0.1
33k
.001
27k
VR1
50k
120k
2.2
TANT
AVERAGING AND INTERFACING
TO AUDIO OUTPUT OF RECEIVER
TPA
2x1N914
D1
D2
10k
IC8
555
10
16VW
2xBAX18
D5
D4
47
16VW
.01
Q1
BC548
+12V INPUT
F1
250mA
LOOM 1
A1
A2
A3
A4
A5
A6
A7
A8
D3
1N4002
470
16VW
IC1
7805
IN
OUT
GND
IN
OUT
GND
E
B
C
VIEWED FROM BELOW

RDF ADAPTOR



The control and antenna switching circuitry is at left while above is the display circuit.

Radio direction finder

The rest of IC5 is configured as a second-order bandpass filter to remove unwanted audio modulation from the 1250Hz tone. The centre frequency of the filter is set to 1250Hz by the clock signal applied to pin 8. This clock signal is derived via IC3 which divides the 1MHz master oscillator signal by eight.

Note that the clock for the bandpass filter is derived from the same source as that used to switch the antennas. This means that the filter is automatically centred on the scanning tone, even when there is some frequency drift.

The output of IC5 (pin 1) is a sine wave with a nominal frequency of 1250Hz. This signal is applied to op amp IC11a which functions as a phase shifter. Adjustment of the phase shifter is by means of VR1.

The job of the phase shifter is to allow calibration of the circuit and to compensate for any audio phase shifts in the receiver.

From there, the signal is further processed by a 4046 phase lock loop (PLL). The function of this stage is to average out any modulation present in the passband of IC5 and to produce a 1250Hz square wave which is essentially free of noise and jitter.

It is this signal that is used to latch IC12. The output of the PLL (pins 3 & 4) is first inverted by IC2f and applied to D-type flipflop IC13a. Subsequently, when D goes high, IC13a latches IC12 on the first positive-going clock pulse from pin 10 of IC4.

The result of all this is that IC12 is latched with a 5-bit code which is directly related to the transmitter direction. A phase comparator function is thus performed.

Note that IC13a is necessary to prevent the latching signal from coinciding with a change of data on IC12's inputs.

A pair of 74LS154 one-of-16 decoders (IC101 and IC102) on the display board converts the 5-bit code to a one-of-32 output. These decoders directly drive the 32 display LEDs to indicate the transmitter position.

Switch SW102 allows the display to be held or "frozen" by resetting IC13a. SW101 serves as a power on/off switch, while SW103 allows the display to be dimmed by switching a 330Ω resistor into the common anode circuit of the LED display.

To make the unit as easy as possible to use, the audio output from the FM receiver is also fed to an internal loud-

Where to buy the kit

The Radio Direction Finder described here was developed by the Research and Development Department at Dick Smith Electronics Pty Ltd. It is available as a complete kit of parts by mail order or from your nearest Dick Smith Electronics store.

The kit comes complete and includes a perspex front panel, screen-printed fibreglass PC boards, antenna bases, plugs and sockets, and a detailed construction manual. The cost is $139 plus postage and packing charges where applicable.

Mail orders should be sent to: Dick Smith Electronics Pty Ltd, PO Box 321, North Ryde, NSW 2113. Phone (02) 888-2105.

Note: all PC artworks for this project are copyright Dick Smith Electronics Pty Ltd.

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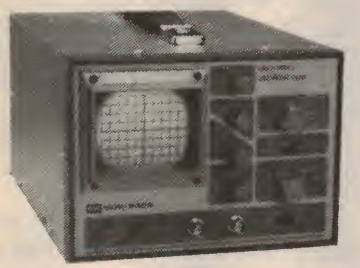

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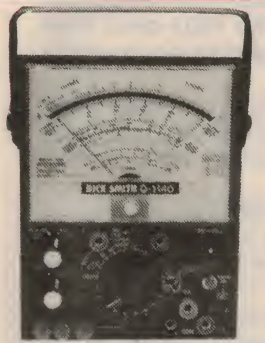

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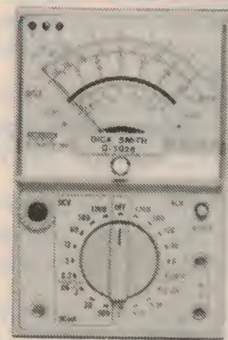

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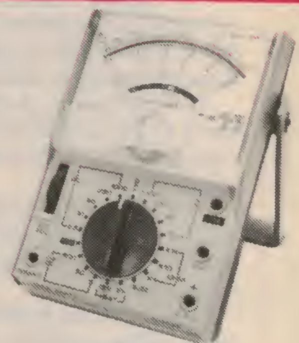

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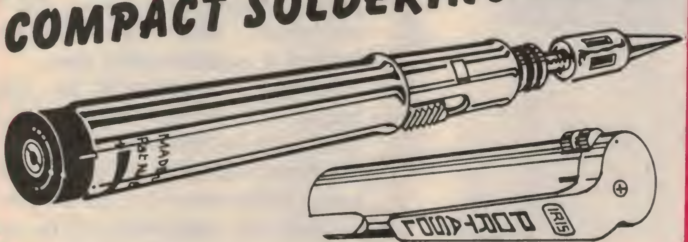

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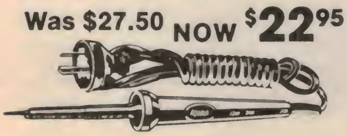

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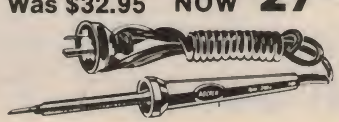

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Radio direction finder

Antennas and Operation

For mobile operation, four ¼-wave vertical whip antennas attached to a roof-rack assembly would be the best approach. The ASU could then be conveniently located between the antennas. It should be weatherproofed using a silicone sealant.

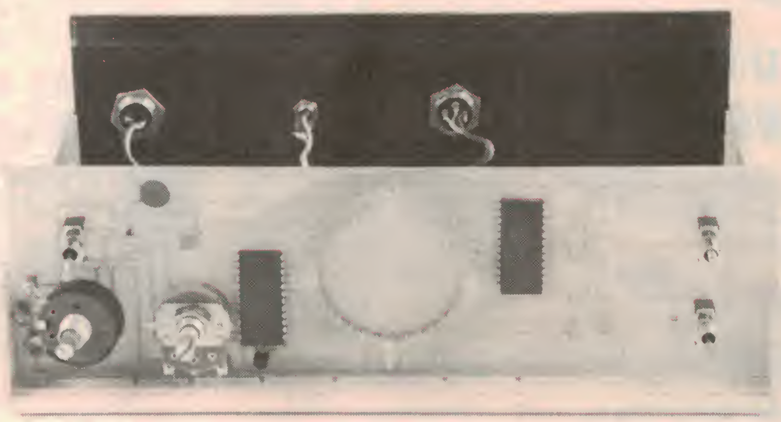
In most cases, a separate ground plane will have to be provided adjacent to the antenna bases. A suggested method is to secure a sheet of aluminium to the roof-rack. Make sure that the assembly cannot come adrift.

A hand-held transceiver can be used to aid the initial setting-up procedure. Depending on the set-up, it may be necessary to "rotate" the antenna array until the compass rose reads true relative to the direction of the vehicle.

The calibrate control can be used to make the final adjustment. A walk around the antenna array with the hand-held transceiver will then reveal if the installation is functioning correctly. This should take place in an open area to avoid strong signal reflections.

In the case of a fixed installation, four ground plane antennas should be mounted symmetrically on a vertical mast, together with the ASU. The array can then be adjusted so that the compass rose displays the true bearing with the calibrate control set to mid-position.

Note that, in either case, the distance between opposing antennas should be between .07 and 0.4 wavelengths.



This view shows the completed display board. The pot leads are soldered to PC stakes.

speaker. The volume is adjusted by means of potentiometer VR102 which is mounted on the front panel.

Power supply

Power for the RDF unit is derived from an external 12V source which connects to a 2-pole socket on the rear panel. This supplies +12V direct to several ICs and to the input of 3-terminal regulator IC1. IC1, in turn, supplies a regulated +5V rail to the remaining ICs.

Op amp IC11b provides a buffered +6V rail to IC5 and also to the phase calibration control (VR101).

Finally, a −9V supply rail is required for the 1488 line driver IC. This is generated by a DC-DC converter circuit based on 555 timer IC8. It buffers a 16kHz square wave derived from IC3 and drives a diode charge pump based on D4 and D5 to produce the required −9V rail.

Transistor Q1 simply functions as a switch. Its job is to interface the +5V CMOS circuit to the +12V 555 circuit.

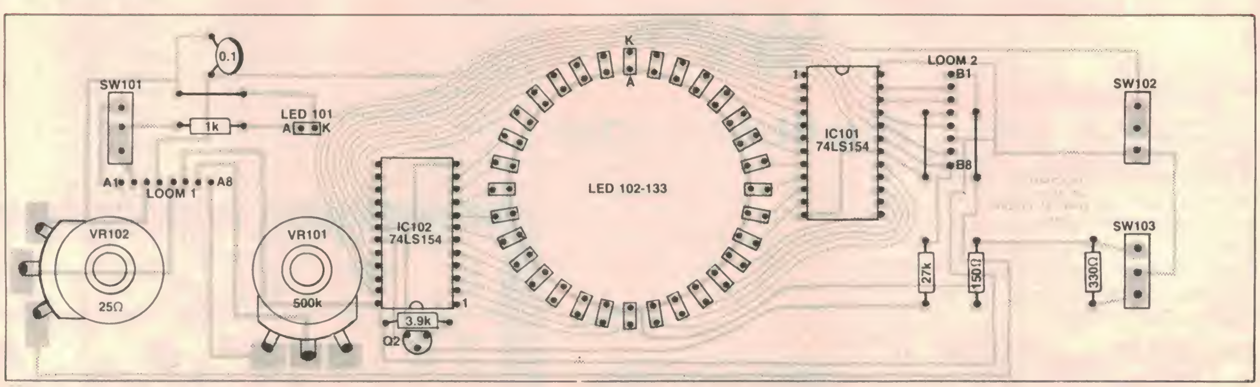
Construction

Construction is straightforward with most of the parts mounted on three PC boards, two in the main unit and one in the ASU. These boards are coded ZA-1543a, ZA-1543b and ZA1543c.

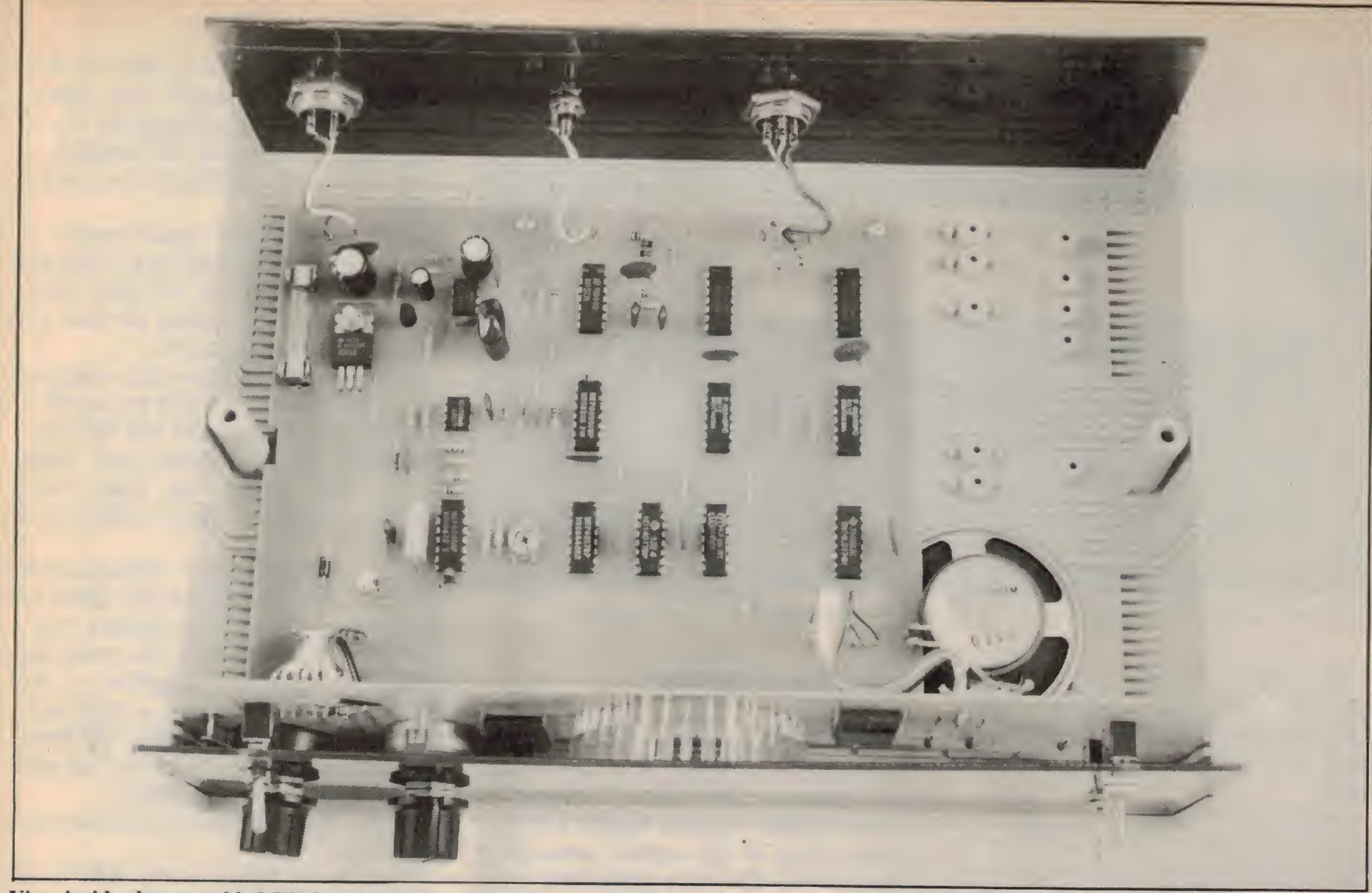
A plastic instrument case fitted with a perspex front panel houses the control electronics, while the ASU board is housed in a plastic zippy case.

Begin by constructing the main PC board (ZA-1543a). No special procedure need be followed when assembling the board although we suggest that the larger components be left till last. Note carefully the orientation of the semiconductors and electrolytic capacitors when they are being installed.

The 7805 regulator is installed so that



Parts layout for the display PC board. Note that the two ICs face in opposite directions.



View inside the assembled RDF adaptor. Note mounting details for the front panel and the display board.

its metal tab lies flat against the board. It is then secured using a machine screw and nut. Note that PC pins are used to terminate all external wiring connections.

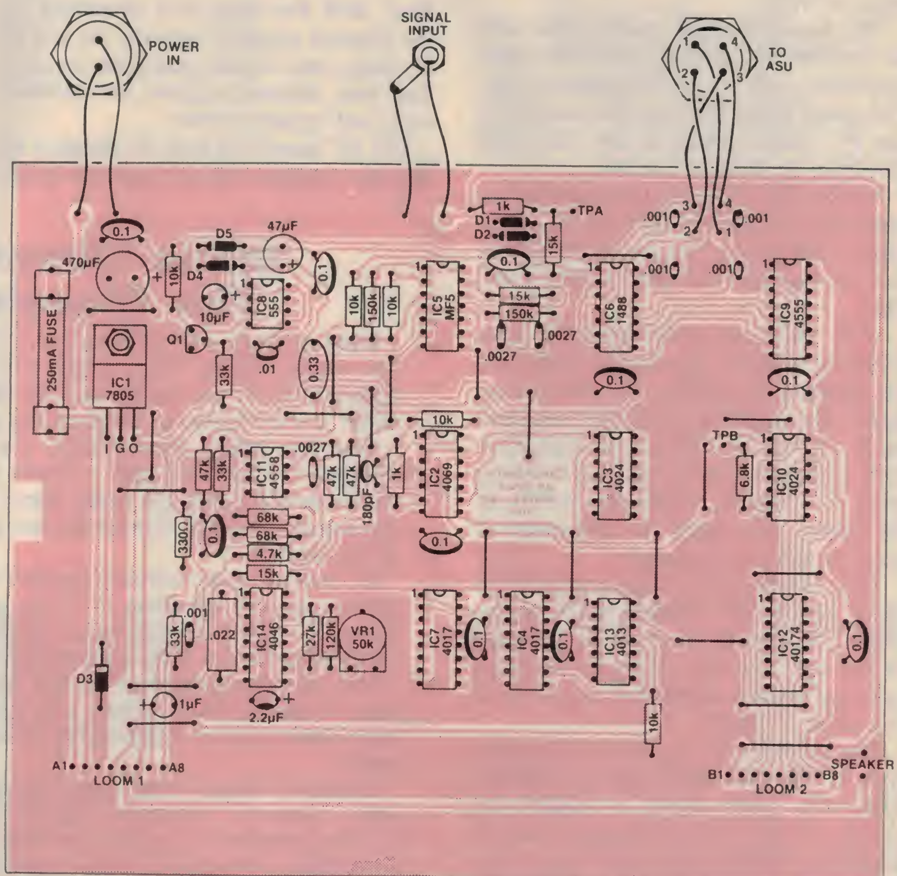
The display board (ZA-1543b) is constructed next. Begin by mounting all parts except for the two potentiometers and the 33 LEDs. Be careful with the orientation of the two LS154 decoder ICs as they face in opposite directions.

PC pins are used to terminate the wiring connections to the main board and to terminate the pot terminals. With the exception of the pot terminals, these should all be mounted on the copper side of the board.

Next, press all the LEDs into the board, noting that the yellow LEDs should be used for the quadrant markers and the red LED for power indication. Make sure that all the LEDs are correctly oriented — the anode lead is the longer of the two.

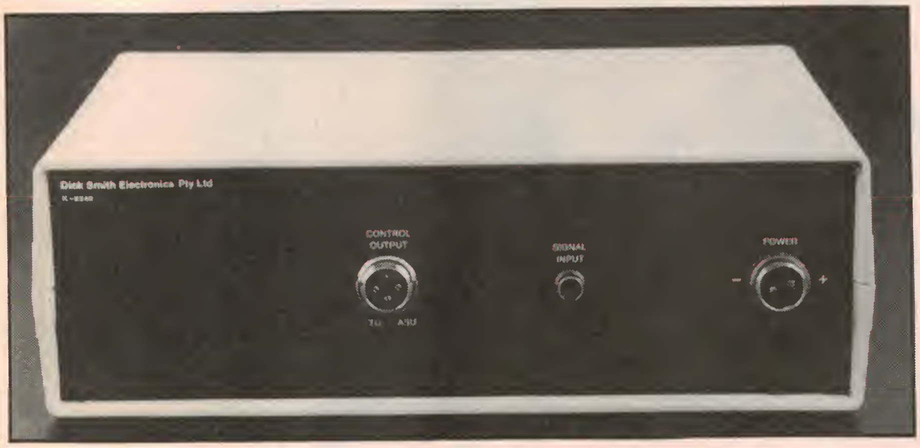
Do not solder them in at this stage as they must be aligned with the front panel later on.

Attention can now be turned to the perspex front panel. Using a smooth file, carefully file a radius on each corner. This is to prevent the right-angled corners of the panel from biting into the instrument case when it is eventually assembled.



Parts layout for the main PC board. Take care with component orientation.

Radio direction finder



The rear panel sockets connect to the ASU, FM receiver and +12V power supply.

The spacing between the PC board and the front panel is adjusted next. This procedure should be followed carefully, as it sets the length of the LED leads.

Attach the two pots to the front panel, then bolt the front panel to the display board via the switch nuts. Note that there should be two nuts on each switch — one behind the panel and the other in front.

The board-to-panel spacing can now be adjusted by inserting them into their respective slots in the instrument case. The panel slides into the first slot while the PC board should fit into the third slot from the front of the case.

Adjust the nuts on the switches as necessary to achieve the correct alignment. This done, the pot terminations can be soldered to their adjacent PC pins.

With the front panel assembly now correctly aligned, the display LEDs can be soldered in position. To do this, remove the assembly from the case and push the LEDs forward so that they butt against their respective viewing windows. Finally, solder the LEDs to the board and adjust the alignment of each by hand as necessary.

This completes the construction of the main board and display panel assemblies. The boards can now be installed in the case and the wiring to the front and rear panels completed according to the wiring diagram.

The loudspeaker is glued to the bottom of the case using epoxy adhesive while the main board is secured by means of the four self-tapping screws supplied. Wiring between the main board and the front and rear panels can be run using rainbow cable.

ASU construction

Commence construction of the ASU by installing the parts on the PC board (ZA-1543c) according to the parts layout diagram. This done, prepare 11 40mm lengths of tinned copper wire and solder them to the socket termination points, with the wires protruding from the copper side of the board.

Once the PC board has been assembled, drill the zippy box according to the diagram supplied with the kit and fit the plugs and sockets (see parts layout). The four antenna sockets are secured using self-tapping screws.

The PC board can now be installed in the case, copper side up, and the leads connected to the plugs and sockets using right angle bends (see photograph). Note the earth-loop for the 4-pole plug. This should be installed to ensure adequate shielding of the control cable.

Next, prepare four equal lengths of coaxial cable (70-100cm) and solder the line plugs to one end of each cable. These are used to connect the four antennas to the switching box.

Diodes D205-D208 are each mounted on the antenna bases which are supplied with the kit. These diodes and the coaxial cables are terminated using extra double-ended solder lugs which have also been included. The procedure is as follows:

First, solder the inner connection of the coax and the anode of the diode to the existing lug on the antenna base. This done, secure the double-ended lug to the ground-plane connection on the base of the antenna with a small self-tapping screw. Finally, solder the braid of the coax to one side of the lug and the diode cathode to the other.

Repeat this procedure for the remaining cables.

Connections between the ASU and the control unit should be run using 4-core cable, while the connection to the FM receiver should be run using coaxial cable. All you have to do is trim the cables to the desired lengths and terminate them with the appropriate plugs.

Note that the wiring connections to the plugs at both ends of the control

Radio Direction Finding: The Classic Technique

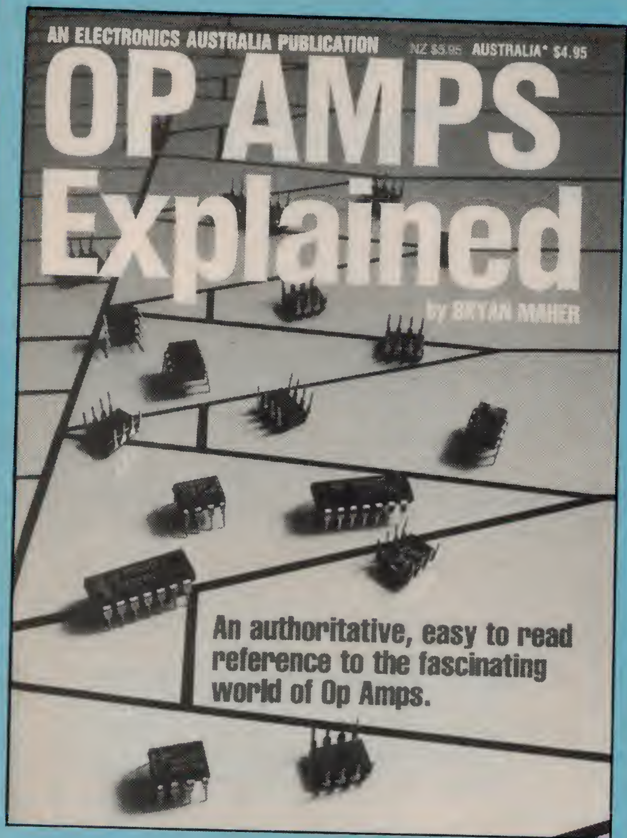
Most readers will be broadly familiar with the concept of a radio direction finder. In its most basic form, it consists of a receiver and an antenna which can be rotated on its own axis. The direction of the transmitter is then found by rotating the antenna for a signal peak or null.

You can easily demonstrate the effect for yourself using a portable transistor radio fitted with a ferrite rod antenna. By tuning the radio to a station and rotating the radio about its vertical axis, a null will be found in the signal strength. The ferrite rod antenna will then point in the direction of the station.

Of course, this method requires that "fixes" be taken at two or more widely spaced locations in order to find the true direction of the transmitter. In fact, two fixes enables the exact location of the transmitter to be determined by simple triangulation.

The classic application of this radio direction finding (RDF) technique was in World War II. Many war movies showed how it was possible to track down enemy transmitters using special vans fitted with RDF equipment.

Typically, these vans were fitted with a large external loop antenna which could be manually rotated. An operator inside the van listened in on headphones for peaks and dips in the signal strength. Provided the transmitter remained in the one location for long enough, its location could eventually be pinpointed.



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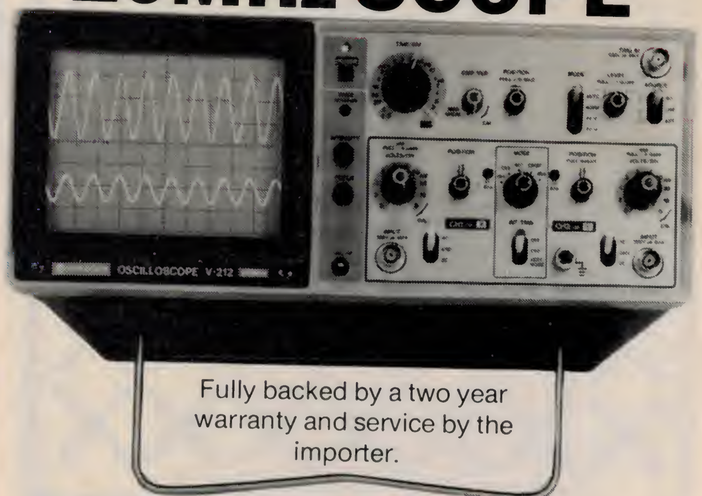

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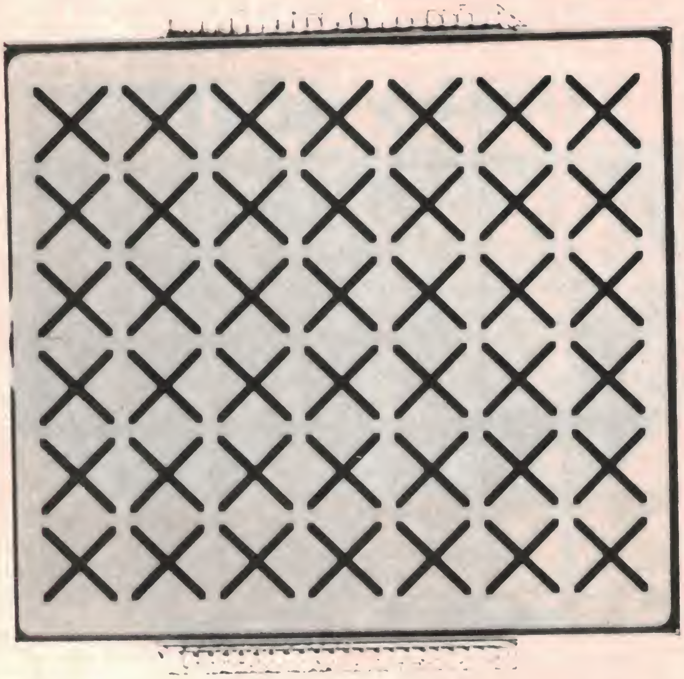

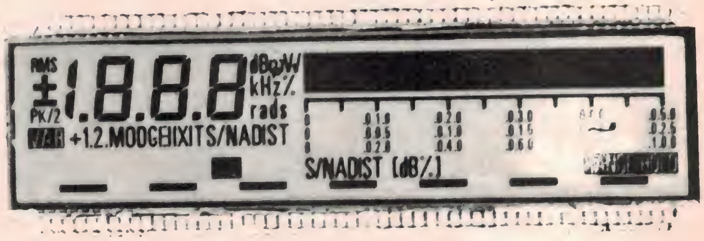

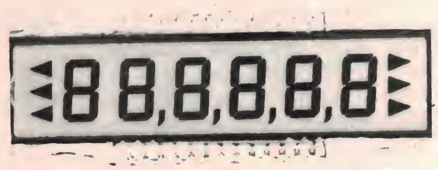

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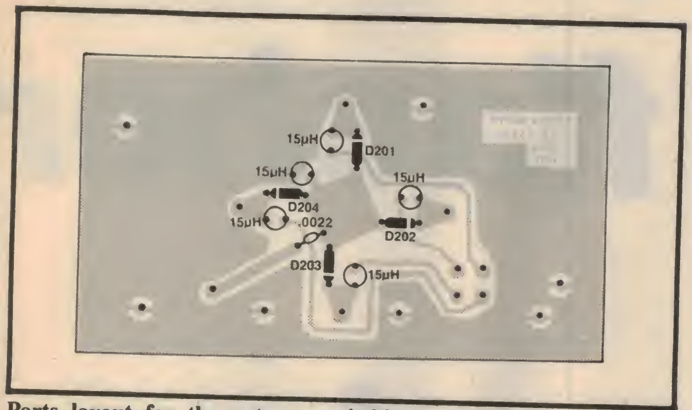
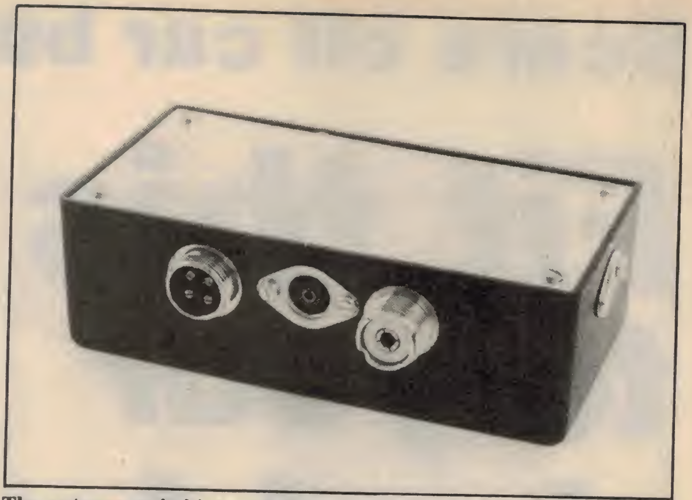
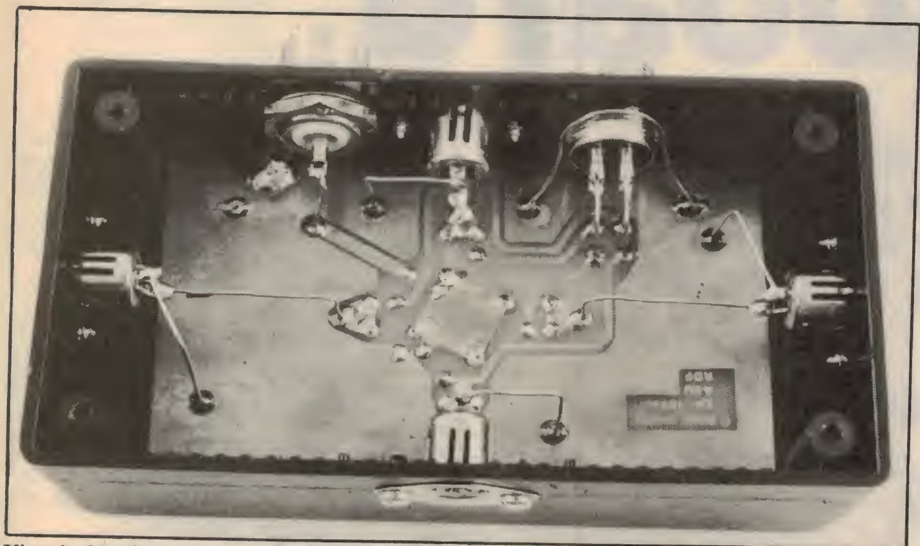


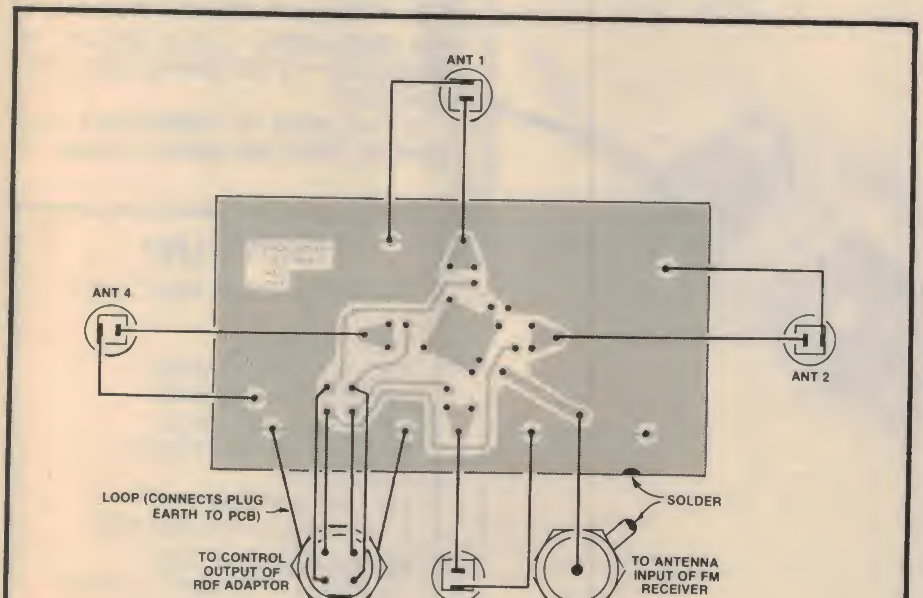
Parts layout for the antenna switching unit. The diodes are all BA244 types.



The antenna switching unit is housed in a plastic zippy case. It can be weatherproofed using silicone sealant.



View inside the antenna switching unit. Note the earth loop for the 4-way socket.



The sockets are connected to the copper side of the PC board using tinned copper wire.

cable must be made on a one-to-one basis, otherwise the antennas will not rotate in the correct sequence.

Setting up

An alligator clip lead and a small screwdriver are all that are necessary to adjust the unit.

Connect up a 12V supply (be careful of polarity!) and switch on with the hold off and the ASU disconnected. All the LEDs in the display should rapidly flicker on and off as the display is scanned.

Assuming all is well, connect the two test points (TPA and TPB) together using the clip lead and adjust VR1 until a single LED is latched. Confirm this adjustment by unhooking and reconnecting the clip lead.

If the display does not latch when the test lead is reconnected, repeat the above procedure. This adjustment brings the VCO to within the capture range of the PLL.

Note that, with the calibrate control at mid-position, the latched LED should be at the top of the circle.

If a dual-trace oscilloscope is available, VR1 can be adjusted for a 90° phase angle between the signal input (pin 14, IC14) and the PLL comparator input (pin 3, IC14).

Finally, the control unit can be checked out by connecting outputs 1, 2, 3 & 4 (to the ASU) in sequence to test point TPA. First, connect ouput 1 to TPA and adjust the calibrate control so that the latched LED is at 0°. The 90° LED should now light when output 2 is shorted, the 180° LED when output 3 is shorted, and the 270° LED when output 4 is shorted.

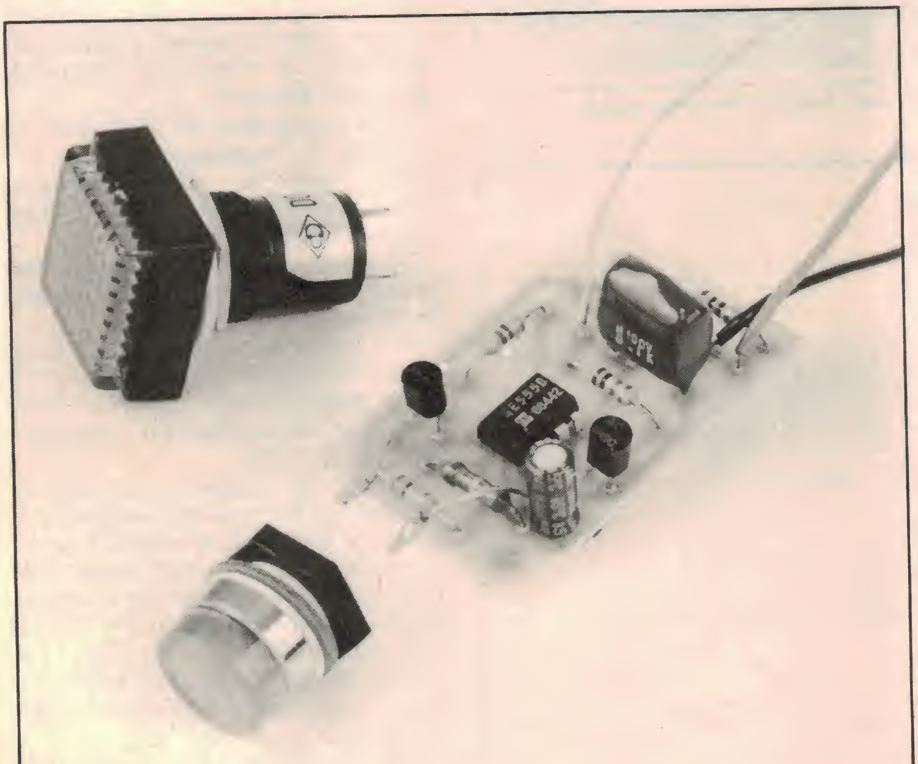
That completes the construction. Your Radio Direction Finder is now ready for use.

Scare off car burglars . . .

Fit this flasher to your dashboard

This is a "Claytons" car burglar alarm — the alarm you connect when you can't be bothered fitting a proper alarm. There is no siren or detection circuit. It simply flashes a light on the dashboard.

by COLIN DAWSON



This view shows the assembled PC board and two lamp bezels (see text).

Sales of car burglar alarms have boomed in recent years. With the poor level of security offered by most cars, and the willingness of many repair shops to buy spare parts with a doubtful background, car thieving has become a growth industry.

Paradoxically, the person most likely to be inconvenienced by a car burglar alarm is the driver. From the moment it is fitted, the hapless motorist is haunted by every alarm in the neighbourhood. In addition, there is the inconvenience of having to enter and exit the car within a specified time.

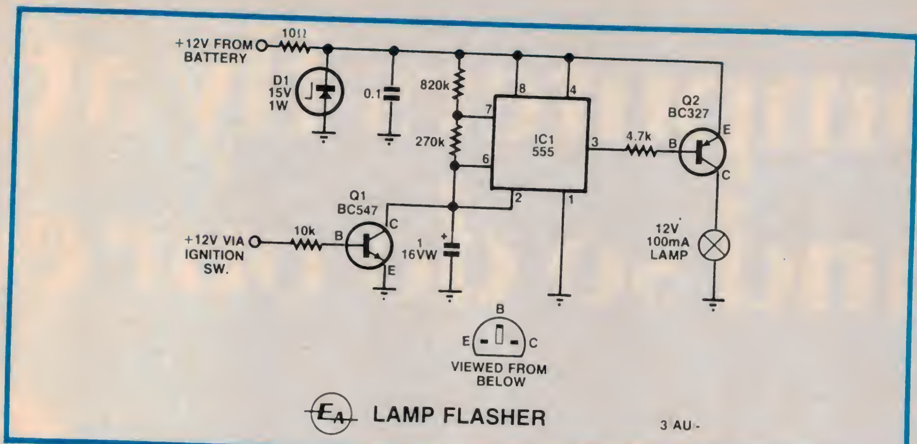
Much of the inconvenience of an alarm can be avoided with a fake alarm. One of the most effective deterrents of any alarm circuit — even the most sophisticated — is the flashing light on the dashboard.

In fact, many car owners have been quick to realise this and have simply fit-

PARTS LIST

1 PC board, code 86au1, 29 x 46mm
1 555 timer IC
1 BC547 NPN transistor
1 BC327 PNP transistor
1 15V 1W zener diode
1 10μF 16VW electrolytic capacitor
1 0.1μF greencap
1 12V lamp bezel (see text)

Resistors (0.25W, 5%)
1 x 820kΩ, 1 270kΩ, 1 x 10kΩ, 1 x 4.7kΩ, 1 x 10Ω/0.5W



The circuit uses a 555 astable oscillator to drive Q2 and the lamp.

ted an authentic-looking flashing light in the place of a real alarm. These are generally purchased from motor accessory shops for around $20.

This type of "Clayton's" alarm has a few advantages. First, it never false alarms during the middle of the night. Second, the driver doesn't have to worry about making a frantic dash for the kill switch upon entering the car. And third, it is far cheaper and easier to install than a real alarm.

By contrast with the commercial units, this unit can be built for around $10 (depending on the lamp used). Once installed, you need never worry about the flasher again. It automatically starts when you switch the ignition off.

The project would be most effective when used with a proper red or yellow square 12V bezel as per the commercial devices. These can be purchased from automotive accessory shops.

Alternatively, most of the kitset suppliers carry round 12V lamp bezels which would still look fairly convincing, particularly if you fit a couple of warning stickers as well.

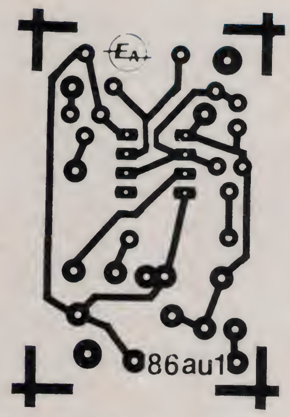
Don't buy a combined switch and bezel — they're too expensive.

Circuit description

The circuit is based on a 555 timer IC. Its configuration in this instance is quite typical, the device being wired as an astable oscillator. This means that it oscillates, with its output (pin 3) going alternately high and low whenever the IC is enabled.

The rate of flashing is controlled by three components: the 820kΩ and 270Ω resistors, and the 1μF capacitor. With these component values, the rate will be about one flash per second. The simplest way to adjust the rate is to alter the value of the 820kΩ resistor.

The enabling aspect of this circuit is somewhat unconventional. During nor-

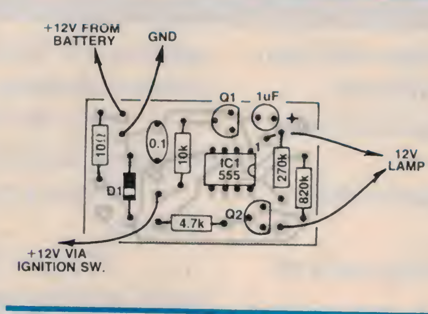


Here is an actual-size artwork of the PC board. It measure 29 x 46mm.

mal operation, pin 2 of the 555 will oscillate between 1/3 and 2/3 of the supply voltage. Clamping it to any fixed voltage inhibits astable operation.

This function is controlled by transistor Q1 and the ignition switch. When the ignition is switched on, transistor Q1 is biased on and clamps pin 2 to ground. This disables the 555 timer and turns the lamp off.

When the ignition is switched off, Q1 turns off and releases its clamp on pin 2. The 555 immediately begins oscillating, its output (pin 3) switching high and low. This drives transistor Q2 which, in turn, drives the lamp.



Parts layout for the lamp flasher. Take care with component orientation.

Power for the circuit is derived directly from the car battery. A 10Ω resistor and 0.1μF capacitor provide supply decoupling while the zener diode clips any voltage spikes exceeding 15V.

Construction

The parts are all mounted on a small PC board measuring 29 x 46mm and coded 86au1. No special order need be followed when assembling the board, but take care to ensure correct orientation of the polarised components.

These include the IC, transistors, zener diode and 1μF electrolytic capacitor.

Once the board has been assembled, it can be tested by connecting the power leads to a car battery. The lamp should immediately begin flashing at a 1Hz rate. The lamp should stop flashing when the input to the 10kΩ resistor is connected to +12V.

Incidentally, we purchased our lamp bezel from RS Components, Unit C, 6 Durdans Avenue, Rosebery NSW. This is a round 14mm bezel and is available for $5.10 (price includes five light bulbs). Alternatively, a larger square lamp bezel (20 x 20mm) is available from Hi-Com Unitronics (7 President Avenue, Caringbah, NSW) for just $1.20.

Installation is straightforward. There's no need to fit the circuit into a case. The best approach is to wrap the board in insulating foam and then tape it in some convenient location behind the dashboard.

The external wiring connections should be run using medium-duty hookup wire. Connections must be made to the power supply, the lamp and the ignition switch.

Note that the latter connection need not be made directly to the switch — it could just as easily be taken from an accessory switch or some accessible point on the ignition wiring. Similarly, the +12V supply rail can also be derived from under the dashboard (eg, from a glovebox light switch terminal or from the headlight switch).

Finally, although the circuit is designed to operate automatically, some constructors may prefer to manually switch it on and off. No problem — just install a switch in the power supply lead and connect the input to the 10kΩ resistor to chassis.

In fact, the 10kΩ resistor and Q1 could be left out of the circuit altogether. It goes without saying that any power supply switch should be well hidden.

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AM3

The walkabout radio

Most miniature AM radios compromise on sound quality but you'll be surprised how good this one sounds. It's a "Walkman" style unit that comes as a kit of parts, ready for easy assembly.

by STEVE PAYOR and DAVID WHITBY

Despite the availability of very cheap commercially manufactured receivers, many people still prefer the satisfaction of building their own, even if the results may not be quite as good as a "bought one".

However, this new circuit, which we have dubbed the AM-3, has a performance for which no apologies are necessary. When fitted in the optional dark brown case, with a precision vernier tuning dial, it has a solid look and a feeling of quality. The sound quality is also excellent — equal to any "Walkman" style portable.

Tuning with the vernier dial is infinitely easier than with the plastic thumbwheel normally found on AM pocket radios.

Building this radio will also save you money on batteries. It requires only a single 1.5V AA cell, and the current drain is so low (only a few milliamps) that the continuous battery life will be measured in months, instead of hours as it often is for a normal 9V transistor radio.

The AM-3 is available as a complete kit of parts from Technicraft Electronics, which saves the effort normally spent in locating the specialized parts such as the ferrite rod and tuning capacitor, not to mention all the "fiddly bits" like screws, spacers etc. High quality components are supplied throughout, including a tinned fibreglass printed circuit (PC) board.

Construction is a "breeze" — all components, including the tuning and gain controls, ferrite rod aerial, battery and headphone socket, are mounted on the PC board. You can build it in this "short" form, then simply drop it into the optional case. The case is supplied with attractive, silk-screened gold lettering and is pre-drilled, so no special tools are needed for a "professional" finish.

Quality lightweight headphones will be made available with either the "short form" or complete kit. Alternatively, you can use any existing type of headphone if you already have a pair.

The circuit is based on the Ferranti ZN414 "radio-on-a-chip" integrated circuit. Previous builders of small radios using this IC will have noticed some shortcomings in its performance: in particular its limited "strong" signal handling capability, and the need for an audio transformer for driving low impedance "hifi" type headphones. The volume level is also inadequate for noisy environments.

These problems have all been rectified in this latest design. An "RF GAIN" control has been added to the basic circuit, which enables the ZN414 to be adjusted for optimum reception of signals of any strength.

A one-transistor audio amplifier has also been added to eliminate any complaints about the volume level.

The AM-3 delivers good quality sound into a pair of headphones.

The ZN414: basic circuit

The ZN414 forms the heart of the circuit. When fed with the signal picked up by a small ferrite rod aerial, it performs all the necessary functions of radio-frequency amplification and demodulation, to produce an audio output sufficient to drive most headphones directly at a modest volume.

Internally, its operation is fairly complicated, but this need not concern us. We can simply view it as a "black box" which produces an output current which is linearly proportional to the amplitude of the RF input.

Physically, it looks like a standard 3-pin transistor package. Normally we would expect an IC to have at least four external connections: IN, OUT, GND and V+. The ZN414 makes do with only three pins by combining the function of power supply and output.

How it achieves this is interesting. In essence, the IC varies its supply current a small amount in proportion to the amplitude of the incoming signal. Thus, by feeding the power to the "output" pin through a 1kΩ resistor, there will be a small AC voltage developed across this load which follows the amplitude variations of the incoming signal.

This is the demodulated audio we are looking for, although it is necessarily rather small, as the "output" pin voltage cannot be allowed to fluctuate too much, since the rest of the circuit derives its power from this point. An audio amplifier is needed for anything more than "headphone listening" sound levels.

Besides RF amplification and demodulation, all "serious" radio receivers also include some form of *A*utomatic *G*ain *C*ontrol (AGC). This is essential as the amplitude of signals from various stations (some close by, others further away) can vary from 10μV to 100mV or more. Without AGC, nearby stations would overload the receiver, giving a harshly distorted output, while distant stations would be barely audible.

The normal ZN414 circuit implements a moderate amount of automatic gain control by feeding the *average* DC voltage at the output back to the input, where the gain is strongly affected by changes in DC bias. When a signal is received, the average voltage at the output drops slightly, and consequently the DC input voltage is reduced, which tends to "turn off" the radio frequency amplifier, reducing the overall gain.

Actual measured voltages for a typical circuit are shown in Fig.1. Notice that the AGC voltage is roughly equal to the output voltage, with any audio or radio-frequency signals removed by the low pass filter formed by the 100kΩ resistor and 0.1μF capacitor. Waveforms are shown for a "normal" signal level (one which just gives full output), and a "large" signal (at the point of output

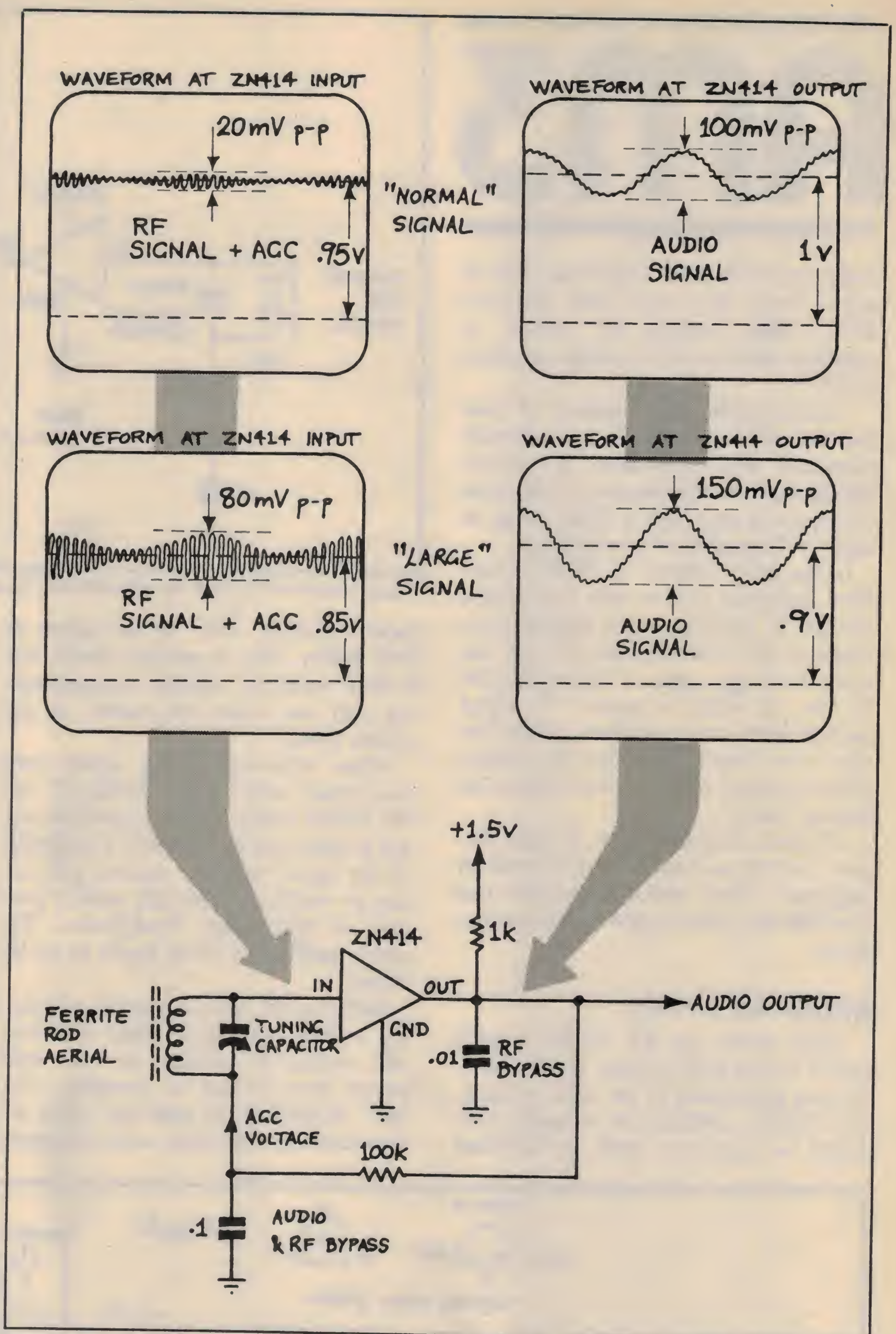


Fig.1: basic ZN414 circuit showing typical waveforms for various signal conditions.

AM3

distortion). For a four times increase in signal input, the output only increases 50%. This amount of control is achieved with an AGC voltage variation of 0.1V.

Unfortunately, this amount of gain control, although useful, is not really adequate. By comparison, a well-designed six or seven-transistor AM radio receiver will cope with a 1000:1 range in signal voltage without overloading.

In the past, builders of ZN414 radios have managed to live with this limited amount of AGC by either adjusting the nominal 1kΩ load resistor to vary the control voltage range, or by rotating the ferrite rod aerial to reduce the signal pickup from strong stations. Many designs even resorted to using the smallest possible ferrite rod, in order to keep the signals "weak".

All these methods work to some degree, but the authors have developed an improved circuit which overcomes this problem and offers some additional bonuses.

Improved circuit

Fig.2 shows an RF GAIN control added to the basic circuit, which allows manual adjustment of the AGC voltage. (RF GAIN controls are normally only found on receivers used by amateur radio operators, who, by the nature of their hobby, like to get the utmost out of their receivers, whether communicating half way round the world, or just across town).

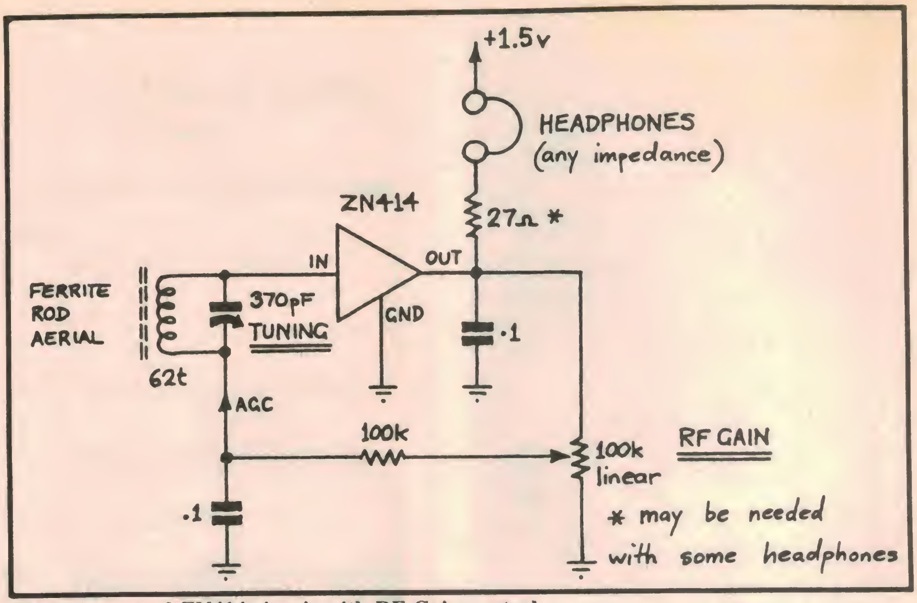


Fig.2: improved ZN414 circuit with RF Gain control.

When receiving strong signals with this circuit, one simply "backs off" the RF GAIN control a little until the signal is clear and undistorted. The fidelity of the signal with the correct gain setting is excellent, especially with a good pair of wide-range headphones. The audio quality has to be heard to be believed!

Reducing the gain too much will drop the volume and cause some distortion, and ultimately silence as the input passes from partial to complete "cutoff". Increasing the gain too much will also result in distortion, and sometimes complete silence on very strong signals, because the ZN414 output stage will be completely "saturated".

On weak signals, the control is advanced to the point where the input just starts to draw appreciable current. This gives the maximum possible gain for receiving distant stations.

You can tell if the control has been advanced too far, as the tuning will become quite broad, and stations will merge together. This is because the input impedance of the ZN414 drops as the input starts to draw current, and the normally sharp response of the tuned circuit becomes progressively damped. The most sensitive point is just before this happens.

All this may sound a little involved, but in practice the correct setting of the

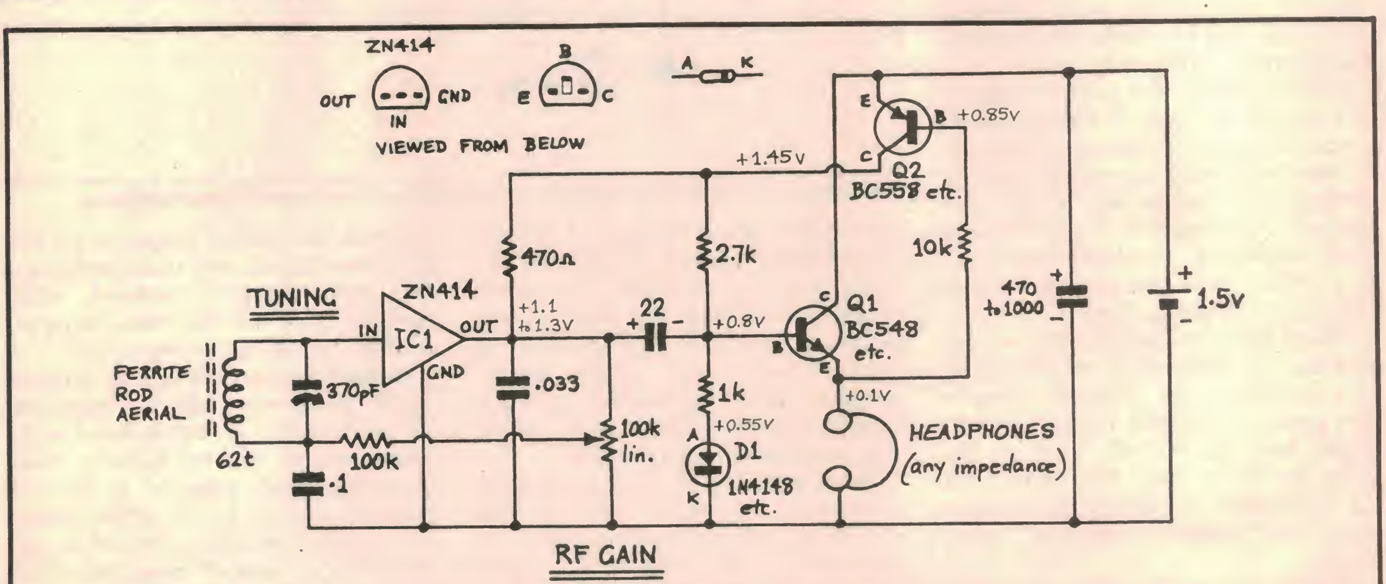


Fig.3: the final circuit for the AM-3 radio. The voltages marked are with 15-ohm headphones in circuit.

gain control is easily found, and this slight added complication is well worth the following benefits:

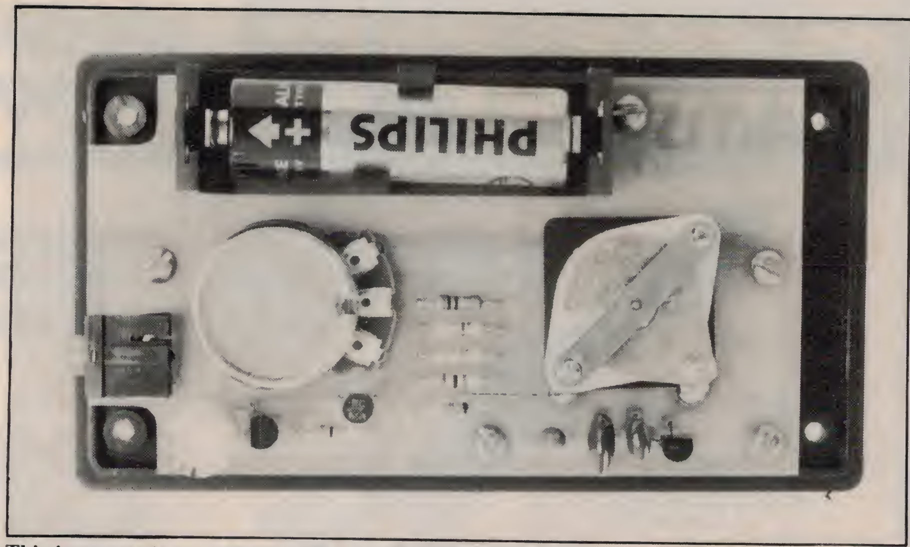
Firstly, distortion is easily minimized, and the sound quality approaches that of the best wideband AM tuners.

Secondly, the 1kΩ load resistor is no longer critical, and the circuit, as it stands, will accept any load between 20Ω and 1.5kΩ. This means that almost any pair of headphones can be used directly, with no real need for the usual output transformer to match impedances.

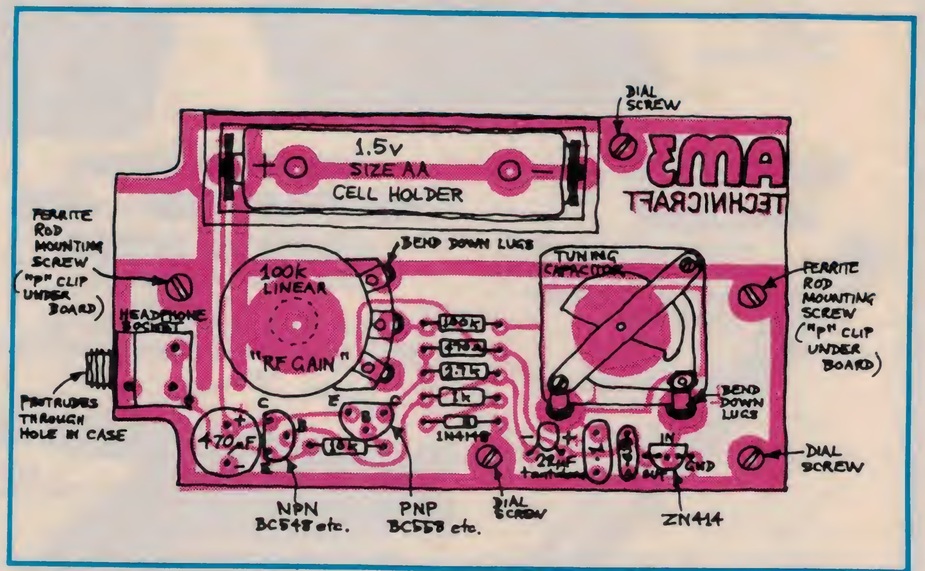
Even with low-impedance "hifi" headphones, the output is better than that obtained using a 1kΩ load resistor and an audio transformer, and the frequency response is limited only by the headphones.

A further spin-off is the fact that simply un-plugging the phones turns off the circuit — no battery switch is needed.

Finally, this circuit is quite tolerant of falling battery voltages. With low-impedance phones, the battery voltage can drop to as low as IV before you run out of adjustment with the RF GAIN control.



This internal view emphasises the simplicity of the AM-3.



Follow this parts layout diagram when installing components on the PC board.

The AM-3: circuit description

The ultimate development of this simple circuit is Fig.3. Here we have added a one-transistor audio amplifier to boost the output to a level sufficient to drive even the most insensitive of modern high-fidelity headphones.

The "auto-power-off" facility has been retained by using an additional transistor to "disconnect" the power to the ZN414 and the audio amplifier when the headphones are unplugged.

RF section: The load for the ZN414 has been set at 470Ω, which is large enough to allow a fair amount of normal AGC action, but small enough to feed sufficient current to the ZN414 under low-battery conditions. With this load, the RF GAIN control will need manual adjustment on only the strongest stations.

The exact value of the gain control potentiometer is not critical — any value from 20kΩ to 200kΩ will do. From here the AGC voltage is filtered by the 100kΩ resistor and 0.1μF capacitor before being applied to the "cold" side of the aerial tuned circuit.

At the ZN414 output, a .033μF capacitor bypasses any RF signals, while a 22μF capacitor couples the audio signal to the output stage.

Audio amplifier: This consists of NPN transistor Q1 which "buffers" the output from the ZN414. An emitter-follower configuration is used here, as we only need to amplify the current (not the voltage) of the audio signal. Class "A" operation is achieved by setting the base voltage to approximately 0.8V, which results in a DC voltage across the load of about 0.1V, which is slightly more than the peak AC signal amplitude.

Q1's base voltage is derived from the voltage divider formed by the 2.7kΩ and 1kΩ resistors, added to the voltage drop across the forward-biased silicon

A kit of parts for this project is available from Technicraft Electronics, 338 Katoomba St, Katoomba, NSW 2780. Phone (047) 82 3418.
Two versions of the kit are available:
(1.) A short form kit: all parts except the vernier dial and case. Price $14.50.
(2.) The full kit: all parts including the vernier dial and case. Price $24.50.

In addition, quality lightweight headphones are available for $7.50 per pair.

Add $3.00 for postage and packing to all orders.

AM3

diode D1. This diode provides a voltage which matches the temperature variations of the emitter-base voltage of Q1. Without D1, the voltage across the headphones would increase excessively if the AM-3 was left out in the sun.

"Power-up" circuit: When a load is plugged into the output, current flows through the 10kΩ resistor, turning on PNP transistor Q2. This applies bias voltage to the NPN audio output stage, and the supply voltage for the ZN414, to within about 50mV of the full battery voltage. With no load, Q2 stays "off" — the only current flowing is a few nanoamps of leakage.

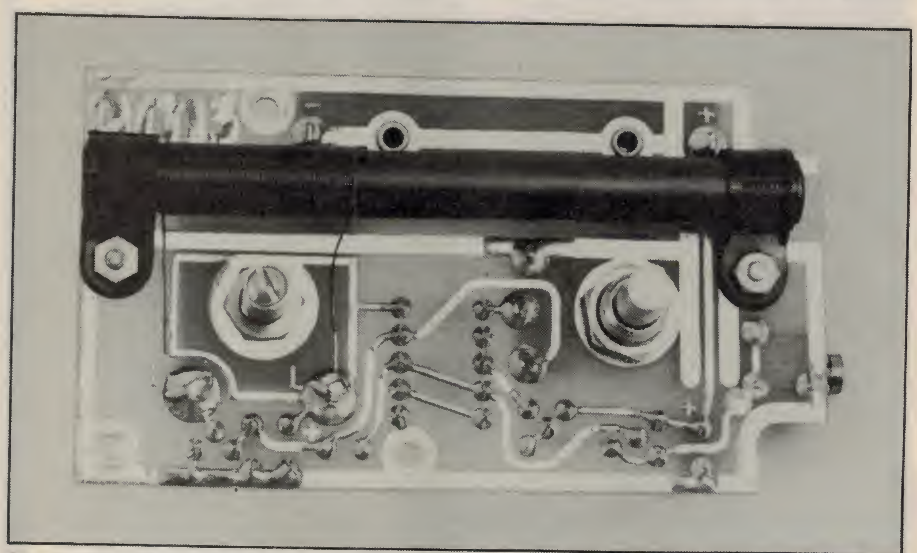
Finally, a 470μF to 1000μF capacitor bypasses any internal resistance the battery may develop as it nears the end of its life.

Construction

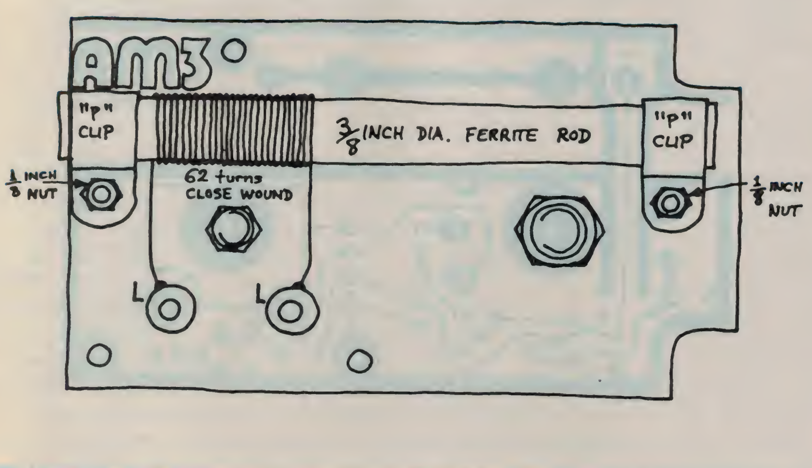
All components are mounted on a single fibreglass PC board. The potentiometer and tuning capacitor are mounted on the component side of the board, and their lugs bent down to protrude through to the track side of the board.

The battery holder and headphone socket also reside on the component side, while the ferrite rod is mounted on the track side. Leave this till last.

When fitting the smaller components, be sure to check the wiring diagram to ensure correct orientation of transistors Q1 and Q2, the diode D1, and the ZN414 (IC1). Check also that the two electrolytic capacitors are the right way around.



The ferrite rod antenna is mounted on the copper side of the board.



Solder the antenna leads to the two points marked "L" (see also above photo).

The aerial coil consists of 62 turns of 0.4mm (26 B&S) enamelled copper wire. This can be wound directly on the ferrite rod if you first remove any sharp edges with some fine abrasive paper. Alternatively, use a single layer of sticky tape under the winding.

Wind neatly and carefully in the direction shown in the wiring diagram, and secure the ends of the coil with sticky tape or two small dots of "super glue". The ends of the winding may now be stripped of enamel and tinned, ready for soldering.

This done, the ferrite rod can be mounted on the solder side of the board with two plastic "P" clips. Check the wiring diagram for the correct way around to connect the coil. Why should this matter? Read on . . .

Troubleshooting Note: (this is a general hint for any circuit using the ZN414 IC). Since the ferrite rod is such a good inductive pickup for radio signals, it also follows that any RF current flowing in the output circuit will also be picked up by the aerial circuit — this is unavoidable. There is a 50:50 chance that this will lead to instability and oscillation (depending on whether the feedback is positive or negative).

Evidence of instability includes whistles and bursts of severe distortion when the RF GAIN control is advanced.

There is no need to panic — the cure is simple. Simply reverse the connections to the aerial coil. If you stick to the circuit layout as described, and wind the coil in the direction shown, all should be well the first time around.

Having soldered the coil leads to the two pads marked "L", the AM-3 is now ready for the "smoke" test.

Initial testing

Temporarily fit the knobs to the tuning and gain controls, turn the gain right up, and set the tuning capacitor to half mesh. Insert a battery, and plug in the headphones — you should hear something at this point.

If not, try the tuning, and if there is still no sound, disconnect the battery and check the circuit carefully. It would be wise to check the current consumption at this point.

Start with the headphones unplugged, and connect up a multimeter in series with the battery. A brief surge of current will flow as the 470μF capacitor charges up, followed by nothing. When the headphones are plugged in, the cur-

rent consumption should be between 3mA and 7mA (depending on the headphone resistance), and the maximum current with a short-circuit load should be about 10mA.

Final assembly

Assuming all is well, you may now fit the board into the case. This is delightfully easy. First, position the two tapped spacers on the bottom dial screws, and the single clearance spacer behind the top of the dial. Line up the extension shaft on the tuning capacitor with the dial bush, and seat the board on the spacers. Two short screws anchor the board to the tapped spacers, whilst one long screw goes through the top clearance spacer into the back of the dial housing.

Set the tuning dial to "0", the capacitor plates to full mesh, tighten the grub screw in the dial bush, and that's it!

When the case is assembled, the headphone socket should nestle snugly in the hole in the side of the case. Additional support for the circuit board is provided by the internal ledges against which it firmly rests. The whole assembly is impressively rugged, and should literally last a lifetime.

Performance

In overall performance the AM-3 is one of the best "beginners" radios ever published. On local stations the sound is loud, and completely free of audible distortion. In fact, the major limiting factor seems to be the audio quality of the program material transmitted by most broadcast stations.

Selectivity is not as sharp as a conventional "superhet" receiver (with its multitude of fixed-tuned circuits), but, on the plus side, it means that no loss of treble results from the tuning being too sharp. The selectivity is adequate even for the Sydney area, where some stations are less than 50kHz apart, while the sensitivity is sufficient to pick up some country stations.

When tested at Katoomba, in the Blue Mountains 100km west of Sydney, all the stations were received quite clearly, and many interstate stations were received at night.

The directional aerial and direction finding

In the "good old days" of broadcasting, all the best 8-valve superhets used a loop aerial. This was simply a large, square tuning coil, up to a metre across, which picked up signals by virtue of the magnetic field of the electromagnetic radiation passing through the loop.

Compared with a normal aerial and earth system (which responds to the electric field component of the radiation), these loop aerials had the advantage of being directional, and could be rotated to pick up the maximum signal from a wanted station, or to minimise the interference from an unwanted one. Signal pickup was proportional to the area of the loop, and consequently they were quite large, but then so were the old valve radios.

All this changed with the invention of transistors and ferrite. Both the radio and its aerial shrunk to pocket size. A miniature tuning coil wound on a rod of ferrite will pick up almost as much signal as a loop aerial. Ferrite has a magnetic permeability many times that of air, and so magnetic fields on the vicinity of the rod are "conducted" through the centre of the coil. Signal pickup is proportional to the length of the rod.

The ferrite rod aerial is sharply directional, just like its ancestor, and the AM-3 uses this to advantage. If you live very close to a powerful station, and wish to receive a distant station which is on a nearby frequency, just rotate the radio (in a horizontal plane) until the interfering signal is "nulled". This will occur when the ferrite rod is at right angles to the incoming magnetic field: ie. when the rod is pointed directly at the source.

This property can be used for direction finding, and triangulation of your position. To do this you will need a compass, and a map with the locations of two or more broadcasting stations marked on it. Air and/or marine navigation charts are best for this purpose.

Attach a plastic ruler to the bottom of the AM-3 case with sticky tape, and check that it is parallel to the internal ferrite rod. Align the map in a north-south direction using the compass. (Most maps have the direction of "magnetic north" clearly marked).

Now place the AM-3 with the ruler on the map and rotate it for a complete null on a selected station. Use the ruler to draw a pencil line from the station location to your estimated position. Do this a few more times with different stations and the intersection of the lines on the map will indicate your position.

Note that longer wavelength stations are more useful as the radiation is less affected by diffraction and reflection from mountains, city buildings etc.

Other Frequency Bands

In fact, a whole band of frequencies below the broadcast band has been set aside specifically for this purpose. Most airports have NDBs (Non-Directional Beacons) which provide voice information about weather conditions etc. (Refer to the article "Weather Radio For Pilots", EA July 1985, for a list of frequencies and locations of airport NDBs).

To tune this low-frequency band, you will need to wind the ferrite rod with 200 turns of 0.25mm enamelled copper wire. On the prototype, this gave a tuning range of 175kHz to 850kHz.

The recommended winding to cover the broadcast band (531-1602kHz) is 62 turns of 0.4mm wire. On the prototype this gave a tuning range from 525kHz to above 2MHz. Less turns can be used if you are interested in reception on higher frequencies. Sydney listeners will be able to tune to VL2UV (University of New South Wales) on 1692kHz.

The ZN414 is designed to work at frequencies up to 3MHz, and individual devices may work at even higher frequencies, although the ferrite rod will start to become a bit "lossy" above this range.

Nevertheless, the AM-3 is perfectly usable for listening in on the lower frequency short-wave amateur bands. Readers can experiment by reducing the number of turns on the ferrite rod a little at a time until they have the desired frequency coverage. Sufficient wire is provided in the kit to wind several coils.

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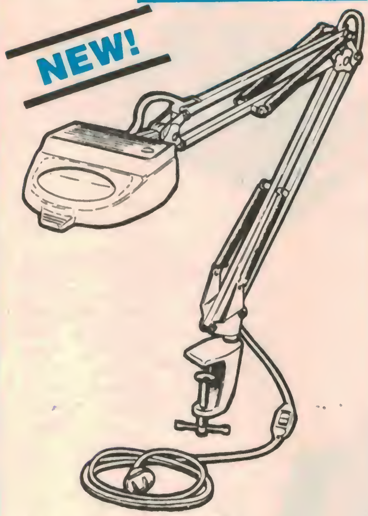

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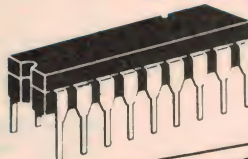

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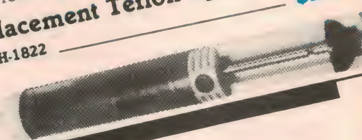

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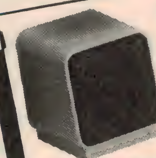

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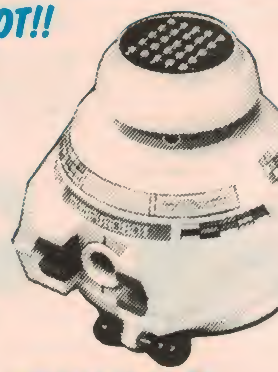

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The Serviceman

Nothing to CRO about in this story

It is bad enough when what starts out as one fault turns into three. It's a lot worse when the third one is one of those "there's-nothing-wrong-but-it-won't-work" types. And it's positively horrific when your most important test instrument simply refuses to cooperate. Many more like this one and I'll head for the bush.

This story is, in one sense, a follow-on from one I told in the November 1985 notes. This concerned the resurrection of a Rank Arena C1851 colour set which had been previously written off, but which I felt was worth restoring on behalf of a local charity — a church community cottage whose previous TV set had finally packed it in.

The set performed well for about six months after I put it into service. Then the staff member in charge of the cottage was on the phone explaining, somewhat apologetically, that the set was giving trouble. As far as I could gather it had been "acting up" for a couple of days, then had finally gone dead.

I wasn't quite sure what he meant by "acting up", and his attempt to describe the symptoms didn't help much, so I simply arranged to pick up the set as soon as I could, and deal with it on the bench.

One objection I have to this set is that, while it uses a 45cm tube, it uses the same size chassis — and many of the same boards — as the original 2601 (63cm) models. As a result, the chassis is a shoe-horn fit in the cabinet and not the easiest thing to extract. But that is more or less by the way.

Once out on the bench, I switched it on and watched for any signs of distress. One showed up immediately; the power supply shut down, clearly indicating that there was some kind of a breakdown pulling the HT rail down and overloading the supply.

A fair bet for symptoms of this kind, in this set, is a shorted line output transistor, TR503. This had already been replaced once in the set's lifetime, the original 2SC1325A being replaced with a 2SD350, a slightly higher rated device. Sure enough, this proved to be the culprit, having broken down completely.

Replacing it didn't present any problem, but I couldn't help asking myself, "did it jump or was it pushed?" or, in other words, was it a spontaneous failure, or had something else failed and taken it out in the process? Well, there was only one way to find out; fit a new one, switch on, and watch for fireworks.

In fact there were no immediate signs of distress. The HT rail came up to normal voltage, sound burst forth from the speaker, and the set showed all the signs of coming back to life. That is, until the picture tube warmed up and a picture appeared on the screen. The first thing I noticed was that there appeared to be no sync in either direction, followed by the realisation that it was underscanning badly in the horizontal mode. I promptly switched it off.

As it turned out, it was just as well I did, otherwise I would have been fitting yet another line output transistor. The set had been on for less than half a minute but the transistor was already up to "sizzle spit" temperature and obviously would not have lasted much longer. So now I had to find fault number two.

How's the tripler?

One possiblity was the tripler. Readers may recall that I had to replace the tripler in the original set and that I used a Philips tripler modified to suit the Rank chassis, employing an arrangement described in the November 1984 notes. What I didn't mention at the time was that the Philips tripler was one salvaged from an old Philips chassis long since junked and ratted for other bits and pieces.

Whether this attempt at economy had now backfired I had no way of knowing, but I couldn't ignore the possibility. Granted, there had been a picture on the screen, meaning that there must have been some EHT present, but stranger things have happened. In any case, it was a simple matter to disconnect the tripler and prove the point.

And this test left no doubt. All signs of distress in the line output transistor vanished, proving conclusively that the tripler was at fault.

Yes it was a strange kind of fault. Usually when a tripler fails — and particularly the Philips tripler — it doesn't muck about; it simply breaks down completely. But this was only a partial failure; probably one diode or capacitor gone leaky and causing enough extra loading to distress the output transistor, yet not enough to prevent it generating some EHT.

Anyway, the remedy was obvious; a new tripler had to be fitted. This time I didn't take any chances; I used a new Philips tripler, modified as before.

Eventually, I was ready to switch on again. This time things looked much more promising; the EHT was normal, the line output transistor was running at a reasonable temperature, and we had full scan width. There was only one snag; we had no sync, either vertical or horizontal. It was possible to juggle the horizontal and vertical controls and produce a temporary picture, but there was no way that either function was going to lock. Fault number three.

Well that was a bit of a set-back. I had started out expecting one fault and was now up to the third. How many more would there be? But I wasn't really all that worried. After all, sync problems are not usually all that hard to track down and, in this case, the failure of both modes seemed like a useful clue; I imagined I would find total loss of sync pulses somewhere in the IF or video stages, due to "crushing" by a faulty stage.

The Rank chassis

For those not familiar with this model, it is very similar to the 2201 and 2601 models and, as I mentioned earlier, even uses some of the same

boards. Signal from the tuner is fed to the video IF board, PWC-312, and specifically to pin 1 of IC201. This IC provides part of the IF chain and also involves the AGC and AFT systems.

A second IC, 202, provides more of the IF chain, the video detector, noise cancelling circuitry, and the take-off for the sound IF.

From here the signal goes to the deflection board, PWC-367 (not to be confused with the deflection-out board, PWC-396). PWC-367 carries the sync separator, sync amplifiers, sync delay amplifers, the vertical oscillator and following amplifiers, the horizontal oscillator, and sundry minor functions.

It was somewhere in this signal chain, and particularly in the IF board, PWC-312, that I expected to find the sync pulses going down the drain. There are two convenient test points in this part of the set; TP208 associated with the video buffer stage on the IF board, and TP31 at the input to the deflection board. In fact, electrically, they have only a 680Ω resistor between them.

I stoked up the CRO, set it to observe the horizontal waveform, and connected it to TP31. Now this should have provided a straightforward observation — either we had sync pulses or we didn't. But it was impossible to tell because there was no way that I could make the CRO lock on the signal. Instead it flashed back and forth across the screen quite randomly. I found it would respond to the horizontal hold control on the set but it was all much too critical to be of any practical value.

So why wouldn't the CRO lock? Frankly, I didn't have a clue. It is a high grade, dual trace instrument which will normally lock on the mere smell of a signal. Was this all part of the fault in the set, or was the CRO on the blink? A quick routine check on known wave forms from another source seemed to clear the CRO of any suspicion, so it was back to the set.

More or less in desperation I moved back to TP208 but found, more or less as I expected, that the situation was exactly the same here. The next logical test point was at TP205, close to the video out terminal, pin 5, of IC202. But, again, there was no way that the CRO was going to lock.

At this point I was completely confused; at a total loss to explain what seemed to be a completely contradictory situation. In desperation I decided that the time had come to abandon the scientific and resort to the primitive — or, more specifically, replace the suspect board with one of a couple of spares I had on hand. While it might not pinpoint the exact trouble it should at least get the set working and perhaps provide some hint as to the nature of the fault.

So out came the video IF board and in went a spare. Then I switched on and tried again. Result; exactly the same as before. This was such a shock that I even went so far as to fit the other spare board. This also behaved exactly as before. About the only thing I had learned from this part of the exercise was that the video IF board was not to blame.

But if it wasn't this board what was it? Something funny in the tuner? (I couldn't imagine what). Well, at least that wasn't hard to check. I had a spare tuner on hand and it was a simple matter to patch it in. Again I drew a blank; no difference whatsoever.

So if it wasn't in the tuner or the video IF board it must be further down the line somewhere, say in the deflection board. I had a spare one of these also, and made ready to change it over. But first I made another observation. By juggling the vertical and horizontal hold controls it was possible to float the picture, momentarily, into its correct position on the screen. And when I did the picture was normal in every way — a good sharp picture with, most importantly, perfect colour.

All of which seemed to suggest that there was little else wrong with the video signal. But that only further confused the issue. So I went ahead and changed the deflection board. This also proved negative.

The last straw

That was the last straw. My mind was going round in circles and getting nowhere. I decided to put the set aside and get on with something useful. Maybe I would think of something when I least expected to. (Or look through the real estate ads for a cheap chicken farm!)

And so I busied myself with more important jobs over the next few days and deliberately didn't go near the set. But I thought about it a lot and, on more than one occasion, reached for the circuit to check out an idea. Most of them came to nothing, but I did eventually come up with one which seemed worth persuing.

This was along the lines that some kind of spurious signal, perhaps from the line output stage, was finding its way back into the IF or deflection boards and, somehow or other, gumming up the sync pulses or sync mechanism. The most likely culprit seemed to be the 19V rail which feeds both these boards. If one of several decoupling networks in this line had failed then it might be feeding line energy into one or both boards.

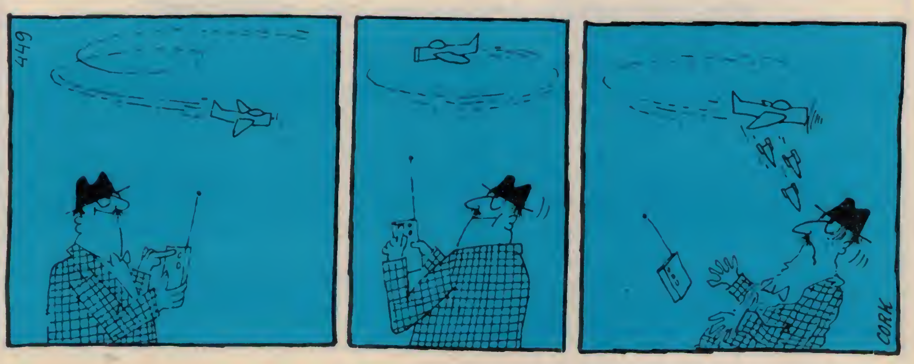
Unfortunately, the CRO quickly disproved this theory, but I still had one other likely path. This is one from the line output transformer (pin 9) via plugs A2 to pin 5 of IC201 on the IF board. This carries a gating pulse of some 35V negative peak, but I was theorising that something may have run amok and created a much larger peak.

Again, the CRO knocked that idea on the head, the waveform being exactly according to the manual.

(Incidentally, the only source of waveforms I have — and the only ones ever published as far as I know — are those in the 2201 manual. This presented a problem later).

And so both ideas had drawn a blank. For the moment I was back to square one with a fault which, seemingly, was even bamboozling the CRO. If only I could get a good look at the waveform and find out what was happening to the sync pulses.

It was at this point that the old grey matter finally began to earn its keep. Some years ago I made up a rather novel piece of test gear consisting of a portable monochrome receiver, with a 15cm screen, which I used for testing



antenna performance in difficult locations. It is simply an El Cheapo unit to which I have fitted BNC connectors to enable video signals to be fed into, or taken out of, the video section as required.

I set this up with its video output feeding one beam of the CRO and with its tuner fed from the colour bar generator. As expected, this produced a typical staircase pattern, complete with colour burst and sync pulse. I then locked the second beam of the CRO to the first one, so that they were sweeping in sync, fed the Rank tuner from the colour bar generator, and connected the second beam to TP31.

And this was the break-through. The CRO remained locked and the colour bar pattern from TP31 was, at long last, clearly visible. What was more, it was a perfect pattern; staircase, colour burst, and sync pulse, exactly as they should be. So there was nothing wrong with the sync pulses this far.

TP31 is at the input to the sync seperator, TR401, and the next two test points, TP32 and TP33, follow this stage. TP32 shows the vertical pulses and TP33 the horizontal pulses. And once again the CRO indicated that the waveforms at both points were exactly as they should be.

All of which put a completely different complexion on the problem. It wasn't a sync pulse problem at all, but something rather more subtle.

At this point I began to formulate another theory. Since it was now virtually certain that there was nothing wrong on either the video IF or deflection boards, it was most likely on the following board, the deflection-out board. And this was the board associated with the two previous faults; the failed tripler and line output transistor. So could a third component have failed at the same time?

AFC circuit

Taking this reasoning one step further I began thinking in terms of the AFC circuit used to lock the horizontal oscillator. According to the 2201 manual this circuit, on the deflection board, is controlled by a pulse from the line output transformer (on the deflection-out board) and fed to the deflection board via the H4 plugs. This is shown as having a value of 250Vp-p at the transformer but, by the time it reaches its destination at diodes D501 and 502, via a complex network of resistors and capacitors, it is down to 4Vp-p.

The main weakness in this little bit of research was revealed when I began tracing out the pulse line on the C1851 circuit, and realised that this is where the two circuits differ markedly. Whereas the pulse is taken off line output transformer pin 3 in the 2201, it is taken off pin 9 in the C1851. Nor is it a passive circuit as in the 2201; it now goes via an AFC amplifier stage, TR505.

Now it didn't need Sherlock Holmes to put that transistor high on the list of suspects: even poor old Dr Watson could have worked that out. Nevertheless, I went through the motions of checking for the pulse at one of the H4 plugs and found, as I expected, that there was no sign of it. I backtracked to the transistor collector with the same result, but found a good healthy pulse at its base.

So it was out with TR505 and in with a suitable substitute. It was almost an anti-climax after that; the pulse appeared where it should and the picture locked up perfectly in both modes, almost as though there had never been a fault. And the CRO, connected to TP31 as in the original set-up, locked up perfectly with no outside assistance.

Then it was simply a matter of tidying up, giving the set a routine once-over and the minor adjustment of the controls, and returning it to the community cottage. In that sense the job was finished. But not in my mind. I kept asking myself why the CRO had refused to lock properly in the presence of this particular fault.

When I was able to think about it a little more calmly, I finally worked out what I believe is the explanation. The truth is that the CRO did not fail to lock; it simply locked on the wrong signal. More precisely it was locking on signals from the line output stage which, along with the line oscillator and in the absence of the AFC pulse, were running free. So, as the line frequency drifted up and down, the CRO went with it.

Unfortunately, the exact mechanism by which this was happening is not quite so clear. My theory is that, in this model set at least, energy from the line output stage is not as well contained as it might be and finds its way into the front end boards either by radiation, conduction through various interconnecting cables, or combinations of these mechanisms.

In any case, it seems virtually certain that, at the various test points I used, there was sufficient line output energy to override the relatively weak sync pulses in the video signal. From a strictly academic point of view this may be criticised as a design weakness but, in practice, it probably doesn't matter two hoots, because the two pulses are locked together anyway.

But disable the AFC pulse and you have the serviceman walking up the wall and across the ceiling — with his bags packed!

Correspondence

That much out of the way, let's look at some letters I have received recently. The first is from Mr C.J.K. of Williamstown, Victoria, and he writes as follows:

The enclosed capacitor (4700μF 16V electrolytic) was part of a power supply for a computer mini disk drive; an MPI B.52 as supplied for a Dick Smith System 80 computer.

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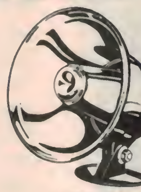

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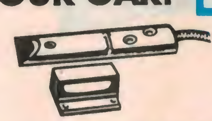

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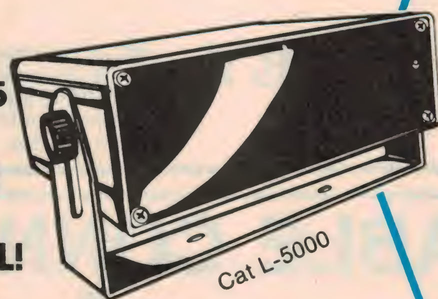

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SEE ADDRESS DETAILS PAGE 98

B.111/CW

the computer would throw a "wobbly" and not cooperate with me.

So one cold night, when everyone had their heaters on, I couldn't take it any more and decided to fix it. After probing around with the CRO I found two faults. The first was in the computer power supply — one of the diodes in the bridge rectifier was open circuit. This was enough to let the 5V regulated supply drop to 4.5V. Replacing the diode solved the problem with the low mains voltage.

However, there was now a problem when loading from the disk drive; it was going into a "wobbly". This is where the capacitor comes into the picture. Although the external appearance indicated that it was correctly oriented, it was in fact in the circuit the wrong way round. This was because the plastic case on the capacitor had been manufactured with the positive indicator pointing to the negative end.

Needless to say a new capacitor cured the problem, but how many other pieces of equipment have one of these capacitors in their circuits with the positive indicator pointing to the negative end? The motto for me: never take it for granted that the indicator on a capacitor is pointing in the right direction.

Thank you C.J.K. for what should be a useful warning for other readers. It is something of a new twist to the old problem of wrongly colour coded resistors, at least under the general heading that you can't trust anything any more.

Finally, I must acknowledge a letter from Mr G.N.D. of North Geelong, Victoria, and apologise for the delay in so doing. This reader wrote after reading my comments in the May 1985 issue, regarding the problem of playing a video tape made in Brazil and which uses a hybrid TV system of 525 lines, 60 fields, and PAL colour encoding.

It is a fairly long letter setting out the world TV standard situation in broad terms and listing several other countries having hybrid standards. For example, Barbados, Bolivia, and Burma use 625 lines, 50 fields, and NTSC colour. It also discusses at some length those systems which are compatible via video tape and those which are not.

Also enclosed was a swag of photocopied pages taken from a couple of magazines. One is called "What Video" and appears to be from the UK and the other is "Videoworld", an Australian publication.

In total, it adds up to a vast amount of information and extremely useful background material, but far too much to reproduce in these notes, even in condensed form. However, it may be possible to reproduce the major portion of G.N.D.'s letter at a latter date, if only to emphasise just how complicated the situation is.

In the meantime, what happened about the tape from Brazil? Well, it's a long story and it took a long time to get results, hence my silence until now. Briefly, it went something like this.

I had found a company willing to "give it a go" but, when they tried to play it, it was found that it had been made to the more recently adopted standard of half speed — though why I can't imagine.

The company had no machine which would play it, but had one on order from the US. So several months went by until this finally arrived, at which point they tried again. This time they had more luck and a playable copy was produced. I use the word "playable" advisedly because, while it moved, talked and had "some colour", it was anything but marvellous.

It was a straight optical copy and, as a result, suffered from very obvious 10Hz flicker, and moire patterning due to the conflict of line standards. But, within a modest price structure, that is about the best that one can expect. For something better you would be looking at several hundred dollars an hour, with a substantial minimum charge.

On the other hand, the charity concerned was delighted. They could see and hear their colleagues in another country and a bit of flicker and patterning was of little consequence. And, to cap it all, the company made only a nominal charge — little more than the cost of the tape — because it was for a charitable organisation.

So everyone was happy.

TETIA Fault of the Month

National TC2202 (MB chassis)
Symptom. Very blurred. Out of focus image. Moving vertical coloured stripes. Sometimes a white line appears at top of screen.
Cure. No vertical scan. R444 (1Ω 1/2 W) open circuit. D407 (UF2) shorted. This removes 24 volt rail. D403 (SV02) has also been found open circuit.

This information is supplied by courtesy of the Tasmanian branch of The Electronic Technicians' Institute of Australia. Contributions should be sent to J. Lawler, 16 Adina St, Geilston Bay 7015.

Third article has the construction details

Playmaster AM/FM stereo tuner Pt. 3

Although the circuit of our new Playmaster AM/FM Stereo Tuner is fairly complex, construction is quite straightforward. This month, we detail the PCB assemblies, give the coil winding details, and present a complete wiring diagram.

by JOHN CLARKE

Because the tuner circuit includes a number of specialised components, we recommend that it be built from a complete kit. This constructional article will assume that pre-punched metalwork has been supplied, along with a screen-printed front panel and all other necessary parts.

A main single-sided printed circuit board (PCB) coded 85tu12 and measuring 330 x 220mm accommodates most of the tuner circuitry. This includes the AM tuner, FM IF strip, filters, and microprocessor control components.

A smaller double-sided PCB coded 85fm12 and measuring 94 x 49mm is used for the FM front end. This board is shielded with a tinplate box and secured to the main PCB with screws and nuts. Electrical connections between the two boards are via an 8-way pin header.

A second double-sided PCB accommodates the display and switch components. Coded 85db12 and measuring 370 x 35mm, it is secured to the front panel of the tuner case. Rainbow cables connect between this PCB and the main PCB via 8-way pin headers and matching cable connector sockets.

Finally, a single-sided PCB coded 85ps12 and measuring 65 x 100mm is used for the power supply circuitry.

The complete tuner circuit is housed in a slim-line rack mounting cabinet measuring 430 x 254 x 44mm.

Commence construction by inspecting the PCBs for shorts between tracks or breaks in the copper pattern. Check also that all the holes have been drilled and that a square cutout has been made in the main board for IC1.

If the square cutout has not been made, proceed as follows: Position IC1 on the underside of the PCB and line up the IC pins with the copper tracks. Now mark the outline of the IC body at each corner with a pencil and drill a large hole in the centre of the marked area.

The cutout can then be carefully filed to the correct size. Once completed, the IC should sit neatly in the hole with all pins lined up with the copper tracks.

Do not solder IC1 in position at this stage.

Begin assembly of the PCBs by installing PC stakes at all external wiring points. These points are clearly indicated on the wiring diagrams. PC stakes are also used on the main board to terminate the connections from the loop antenna sockets and to terminate the leads to T1.

Note that PC stakes 1 to 8 on both the main and power supply PCBs are inserted upside down (ie, with the shorter section on the component side). This is to allow the power supply wiring to be run to the underside of each PCB.

The PC stake on the display PCB (at point 11) is also inserted this way. All other stakes are inserted conventionally, with the longer section on the component side of the board.

Main PCB

Continue assembly on the main PCB by installing all the low profile components. These include the wire links, resistors, diodes, ICs and transistors. Note that some of the resistors are 2% tolerance types. These are marked with a star on the parts layout diagram.

Check the orientation of the diodes, transistors and ICs when they are being installed. Be sure to use the correct semiconductor type at each location.

A special technique is used for soldering IC1 into position. This is a surface-mounting component containing 52 closely-spaced leads. As a result, normal soldering methods will cause solder bridges between the tracks.

First, use your soldering iron to tin each of the copper track lands where the pins of the IC will make contact. Use a soldering iron temperature that is just sufficient to melt the solder and quickly tin the copper with a thin layer of solder.
along each of the pre-tinned leads of IC1 to clean them. The IC can then be installed from the copper side of the board with the pin 1 indication (a dot in one corner) positioned as shown in the parts layout diagram.

To solder the IC, first clean the tip of your soldering iron with a damp sponge to remove any excess solder. Now heat each corner pin of the IC along its whole length so that it melts the solder on the copper track below. At the same time, use a small screwdriver to hold the heated pin hard against the PCB until the solder cools.

The remaining leads of IC1 are then soldered in similar fashion.

The main PCB assembly can now be completed according to the wiring diagram. This involves installing the capacitors, ceramic filters, trimpots, 8-way pin headers, regulator ICs and the crystal.

Note that the display +5V regulator lies flat against the PCB and is fitted with a small U-shaped heatsink. Apply a smear of heatsink compound to the back of the regulator tab before bolting it down.

Six different capacitor types are used on the main PCB: electrolytic, tantalum, supercap, metallised polyester and two types of ceramic. The electrolytics and tantalums are the only polarised types. The supercap is non-polarised and can be inserted either way round.

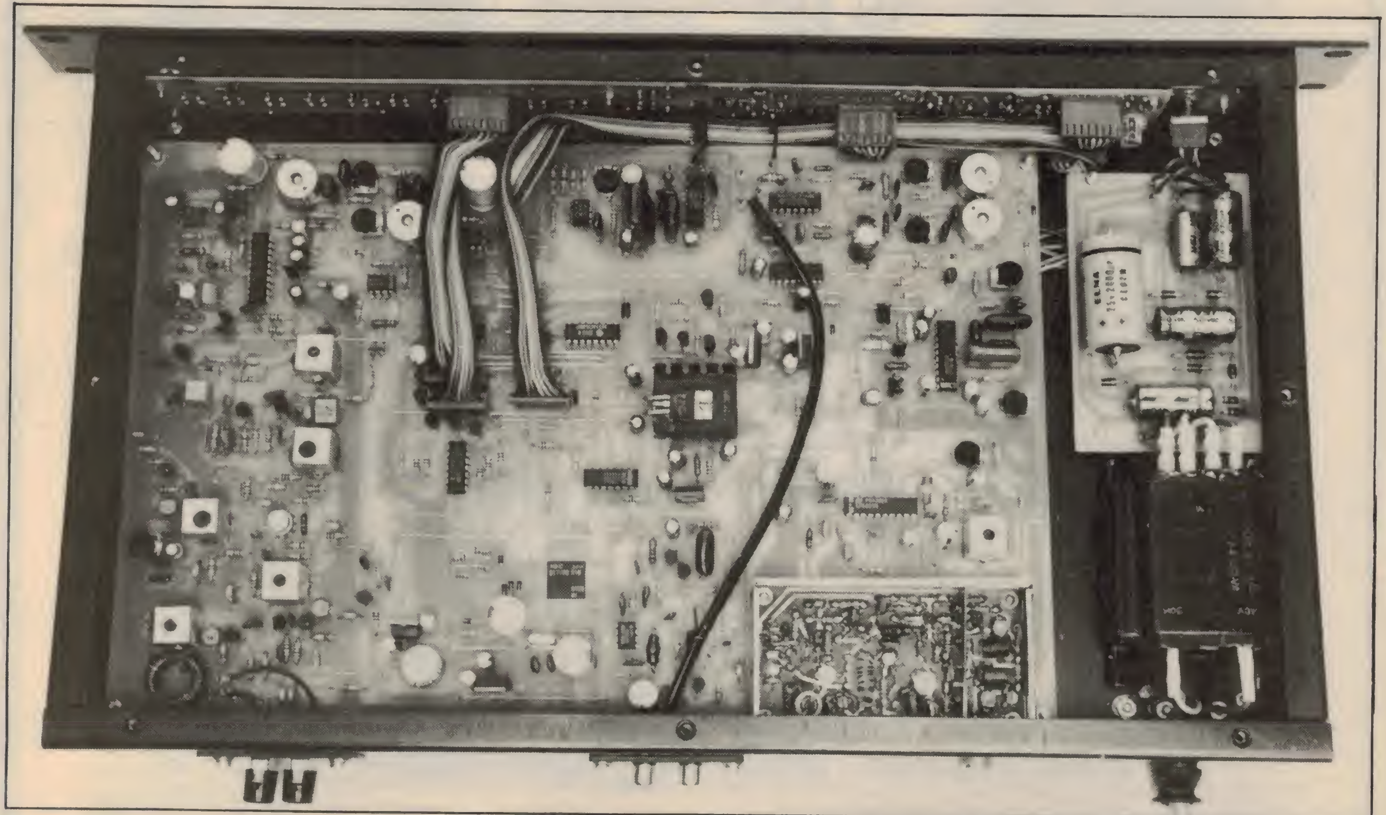
The Philips miniature ceramic plate capacitors are flat-bodied types with yellow bodies and coloured tops. Do not substitute for these capacitors otherwise the tuner will be microphonic. They are marked on the parts layout diagram with a small cross.

The three trimmer capacitors in the AM tuner section should all be oriented so that the flat side of the trimmer body is inserted into the ground track.

Ceramic filters

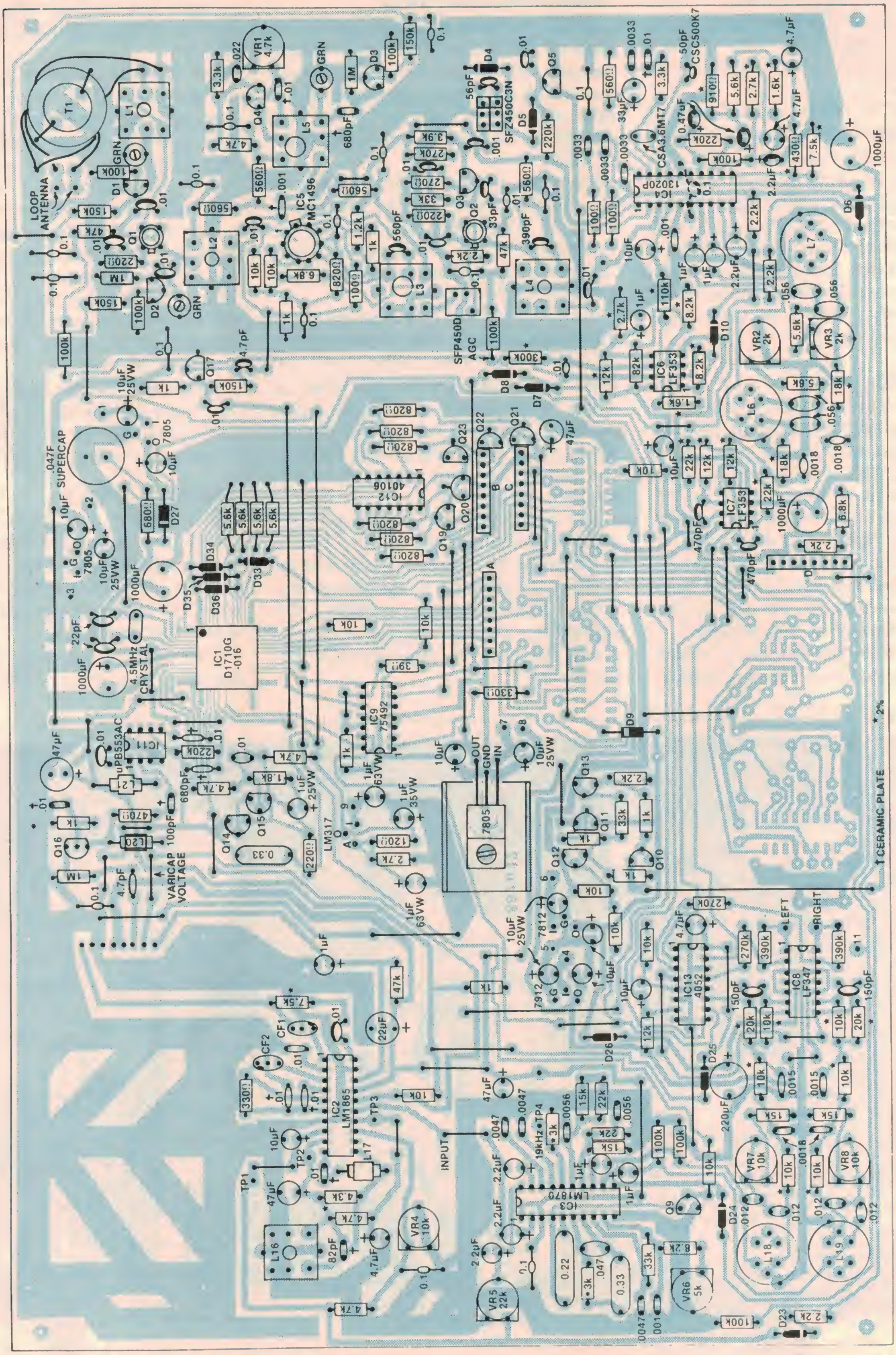
Five ceramic filters are used in the circuit, two in the FM tuner and three in the AM tuner. The SFE10.7ML ceramic filters in the FM section (CF1 and CF2) have a dot on the body to indicate the output pin.

The SFP450D can only be installed one way, while the SFZ450C3N narrow



Repeated from last month's issue, this view shows the layout inside the chassis. The FM front end is at bottom right.

Playmaster stereo tuner



Here is the parts layout for the main PC board.

band ceramic filter should be installed so that the arm of the cross embossed on top of the filter body is adjacent to the right hand side of PCB. The CSA3.6MT7 resonator can be installed either way round.

Coil winding

Fig.1, Fig.2 and Table 1 show the coil winding details. To avoid confusion, we recommend that each coil be soldered into circuit as it is completed.

The 16-turn centre-tapped primary of T1 is bifilar wound (see Fig.2). To do this, cut two 550mm lengths of 30B&S enamelled copper wire (ECW) and twist the two wires together using a hand drill until there is about one twist every 3mm.

Wind 16 turns on the toroid and determine the ends of each winding using a multimeter. The 50-turn secondary can now be wound on the opposite side of the toroid using 36B&S ECW.

Fig.2 shows how the primary and secondary windings are connected to the PC stakes on the main PCB. The toroid is secured to the PCB using two wire straps as shown in the layout diagram.

L1 is a standard 7210 coil which requires an extra winding between pins 4 and 5. To do this, first remove the metal cover from the coil baseplate. This done, jumble wind 50 turns of 36B&S ECW on the stem above the ferrite shield for the main coil. A few drops of molten candle wax over the coil will hold the windings in place.

Clean the ends of the wire with a sharp knife or fine glass paper and solder them to terminals 4 and 5. Finally, replace the metal shield.

L3 is wound on an E1 coil assembly. Cut two 755mm lengths of 36B&S ECW and twist them together using a hand drill so that there is about one turn every 3mm. Wind on 60 turns and separate each winding by testing for continuity with a multimeter.

It is important that the start of one winding be connected to pin 5 and the start of the other to pin 4. The finish ends of the windings go to pins 4 and 6 respectively.

The 46 turns of 36B&S wire can now be wound on top of the bifilar winding. This done, slip the ferrite cylinder over the winding, install the plastic cover and screw in the ferrite slug. Finally, replace the metal shield.

L5 is also wound on an E1 coil assembly and is critical for correct oscillator operation. Table 1 has the winding details. Be sure to wind all coils in the same direction and seal the windings with wax after they have all been completed.

Table 1

Coil	Type	Wire	Turns	Start	Finish
L1	7210	36B&S jumble wound	50	pin 4	pin 5
L3	E1	36B&S	60	pin 5	pin 4
		36B&S bifilar wound	60	pin 4	pin 6
		36B&S jumble wound	46	pin 2	pin 3
L5	E1	36B&S	6	pin 2	pin 4
		36B&S	70	pin 4	pin 3
		36B&S	7	pin 2	pin 1
		36B&S jumble wound	9	pin 6	pin 5
L6,L7	PL14/8	36B&S jumble wound	250	pin 3	pin 5
L15	E3	30B&S	16	pin 1	pin 6
		30B&S jumble wound	7	pin 4	pin 3
L16	A5	30B&S single layer wound	16	pin 1	pin 6
L18,19	PL14/8	36B&S jumble wound	250	pin 3	pin 5
L21		26B&S single layer wound	13 turns on F16 slug		

Fig. 1

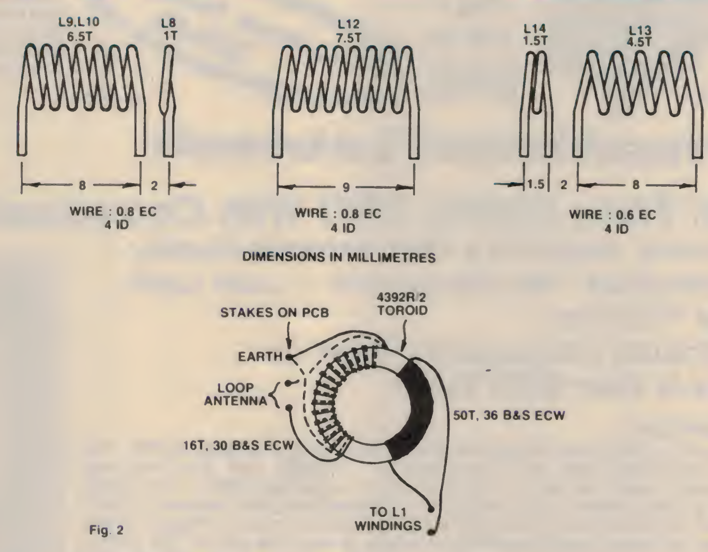


Fig. 2

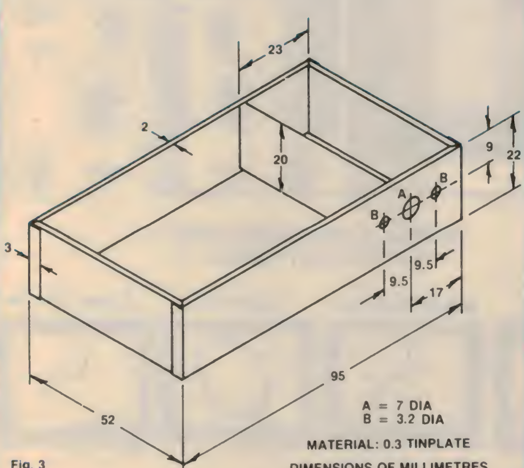
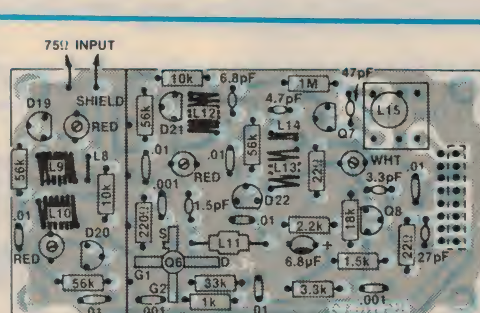


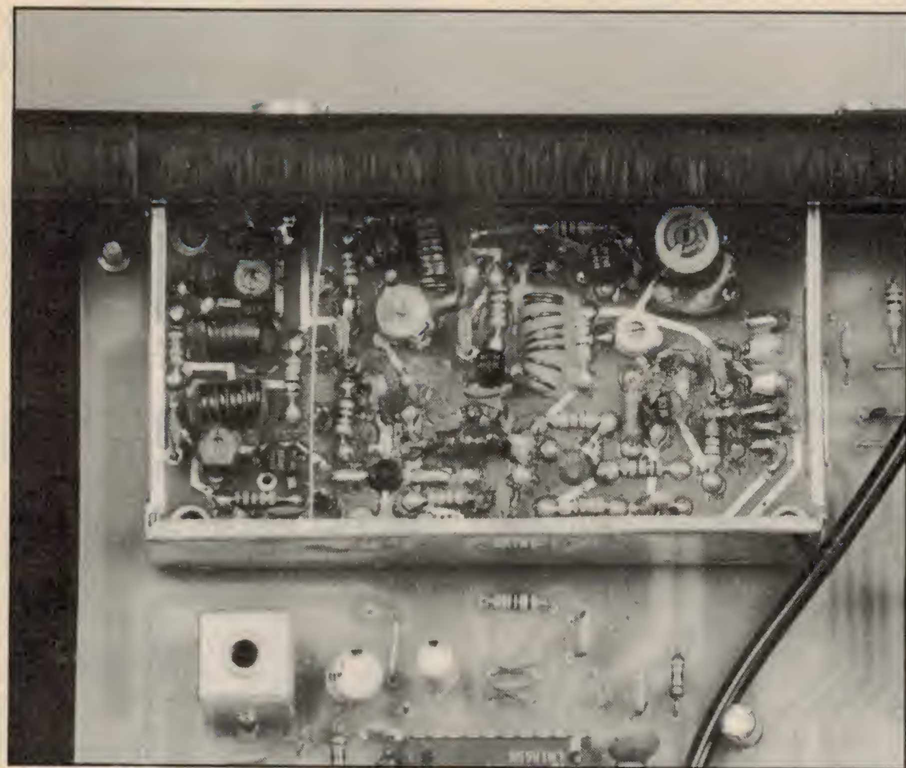
Fig. 3

This diagram shows the dimensions of the metal shield for the FM front end.

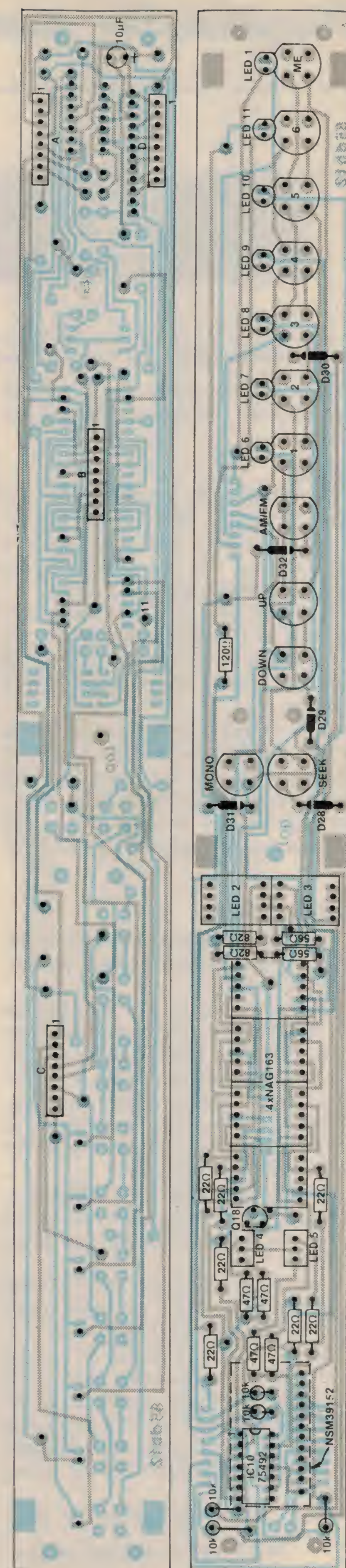


Parts layout for the FM front end. The parts are mounted on the track (blue) side of the PCB.

Playmaster stereo tuner



Above: view of the FM front end. The coils are waxed after alignment to prevent microphonics. At right are the parts layout diagrams for the display PCB.



LED 4, LED 5, SWITCHES AND DISPLAYS ARE MOUNTED ON MOLEX PIN SOCKETS

L6, L7, L18 and L19 each require 250 turns of 36B&S ECW wound on PL14/8 formers. These coils are best wound using a hand drill. The coil former can be held between two washers with a bolt and nut to secure the assembly. The bolt is then held in the drill chuck.

A small amount of molten wax can be used to keep the winding in position. Alternatively, insulation tape can be used.

Note that there are two halves to the PL14/8 potcores: the basecore which includes an integral nut, and the top half from which the inductance adjustor enters to screw into the nut. The two halves go together and enclose the coil former.

This assembly is housed within the brass container with the spring located between the top of the container and the top half potcore.

Be sure to solder the leads of the windings to pins 3 and 5 as shown on the baseplate diagram. The baseplate then inserts into the brass container and is aligned so that the rectangular cutout in the side of the container coincides with the slot on the baseplate. Tabs on the container bend over to hold the completed coil assembly together.

L16 and L21 are relatively straightforward and consist of single layer windings on their respective formers (see Table 1). Seal the L16 winding with wax after it has been completed.

FM front end

The first thing to note here is that the parts are installed on the track side of the 85fm12 double-sided PCB. This means that the component leads must be soldered on the component side of the PCB and, in some cases, on the groundplane side as well.

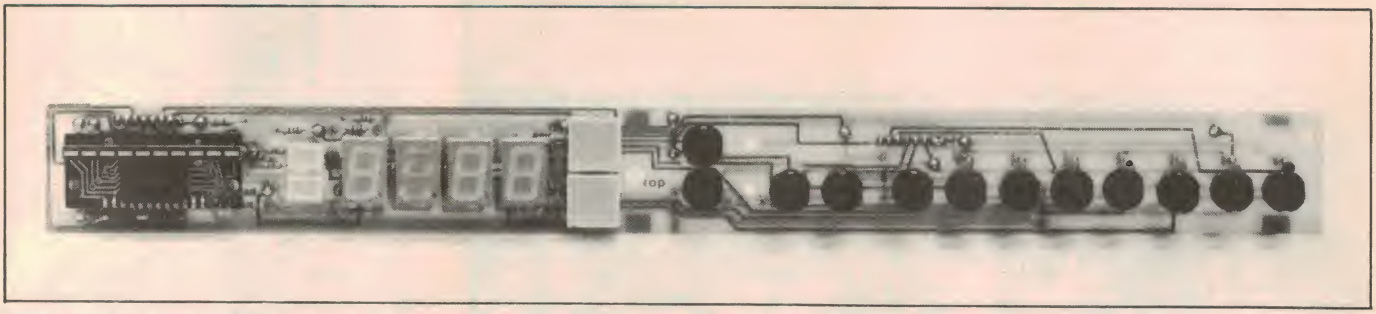
The procedure is quite simple: just remember to solder each component lead wherever it passes through a copper pad.

Begin by installing the six PC stakes (two for the antenna input and four to support part of the metal shield). The resistors, capacitors, transistors and varicap diodes can then be installed, together with inductor L11.

Keep all component leads as short as possible. That is mandatory if it is to perform well.

The 8-way pin header is shown dotted on the parts layout diagram. It is mounted on the underside of the board. Note that several through-board links must be installed adjacent to the pin header.

The trimmer capacitors should be ori-



The assembled display PCB. Note that many of the parts are mounted using Molex pins (see text).

ented so that the pin on the flat side of the trimmer moulding connects to ground.

Coils

Diagrams for the air wound coils are shown in Fig.2. These should all be tightly wound on a 4mm mandrel (eg, a 5/32-inch drill bit) to agree with the dimensions shown on the diagram.

Be sure to wind each coil in the direction indicated in Fig.2 so that it will correctly fit the PCB. Remove the enamel from the ends of the windings before soldering.

L15 is wound according to the data in Table 1 but note that the metal cover is not used with this coil. Note also that the coil must be waxed to prevent microphonic effects. The pins of L15 are soldered to the underside of the PCB only.

Metal shield

A tinplate metal shield surrounds the FM front end and the diagram for this is shown in Fig. 3.

Cut the tinplate to size with tinsnips and bend up the pieces with flat nose pliers. This done, drill holes for the 75-ohm panel socket and attach it to the panel using machine screws and nuts. The side pieces can then be soldered to the ground plane of the PCB and the corners soldered together.

The inner shield piece is soldered at either end to the side pieces and also to the four PC stakes located in-line across the PCB.

Connections between the 75-ohm socket and the PCB are made using short lengths of tinned copper wire.

The FM front end module is secured to the main board using screws and nuts. First, insert the screws from the top of the FM front end PCB and screw on the nuts. The nuts are then soldered to the PCB groundplane and the screws removed.

Finally, mount the module in position, secure it by inserting the four screws from beneath the main PCB, and solder the 8-way pin header.

That completes the FM front end.

Display PCB

The display PCB (85db12) involves several unusual construction methods, so it would be wise to read the following procedure carefully.

There are two overlay diagrams, one showing the components on the top of the PCB and the other showing the components mounted on the underside.

Begin assembly by installing the resistors, diodes, transistor and IC10 on the top of the board. Note that some of the resistors are mounted end-on. As before, component leads must be soldered to both sides of the PCB.

Those pads that do not hold component leads are used for through-board links. There are nine of these through-board links in all.

LED 4, LED 5, the pushbutton switches and the 7-segment displays are all mounted using Molex pins. Take care not to get solder inside the pins when soldering them to the top of the board. You can avoid this by soldering on the flat side of the pin only.

Once the Molex pins have been mounted, the displays and switches can be installed. Orient the switches so that the flat of each switch body faces the right hand side of the PCB.

The 7-segment displays and switches are pushed all the way into the Molex pins, while the LED 4 and LED 5 bar modules are only partially inserted. Line them up with the tops of the 7-segment displays, then solder the bar modules to the Molex pins to secure them.

LEDs 2 and 3 are installed by standing them off the PCB as far as possible.

The NSM39152 bar display module is mounted proud of the PCB using 0.7mm tinned copper wire. You will need 12, 15mm lengths. Solder these into the edge connector bus, then mount the module on the PCB so that it lines up with the 7-segment displays.

The rear side of the display board carries the 8-way pin headers and a 10μF electrolytic capacitor. Solder these in position, then return to the top of the board and install LED 1 and LEDs 6-11 in position (but don't solder them yet).

Next, mount the display PCB on the sub-front panel using 12mm standoffs and countersunk screws and nuts. The front panel can then be bolted to the case using the Allen screws supplied, and the LEDs pushed into the front panel holes. Check that the LEDs are all correctly aligned before soldering their leads.

At this stage, you should check that all switches operate without sticking before removing the display board from the front panel assembly. Any switches that catch in the front panel holes can be adjusted by carefully bending the supporting Molex pins.

Construction of the display PCB can now be completed by soldering the LEDs to the pads on the top side of the board.

Power supply PCB

Assembly of the power supply PCB (85ps12) is straightforward. The main point to watch here is that one of the 470μF capacitors must be rated at 63VW (to allow for variations in mains voltage). The other two 470μF capacitors are rated at 25VW.

Check the orientation of each component before soldering. The diodes are all 1N4002 types.

Chassis assembly

Now that all the PCBs have been completed, wiring can proceed between the power supply PCB and the main PCB. This wiring is run beneath the two PCBs and must be installed before the boards are mounted in the case.

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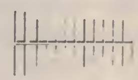

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Cat K-6312

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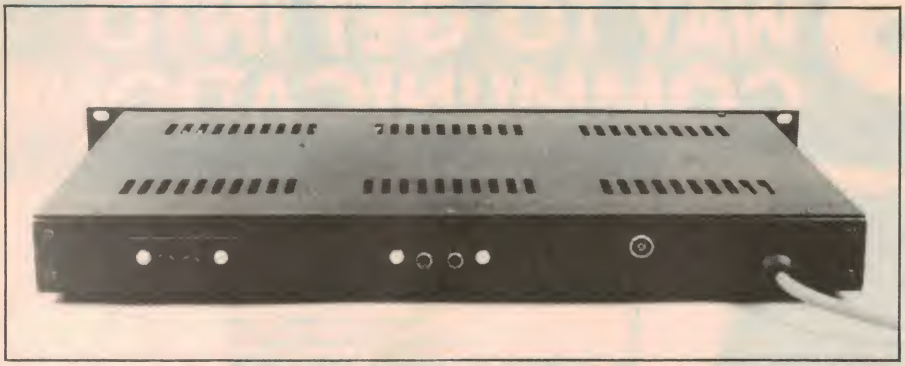


The rear panel carries the antenna terminals and a pair of RCA audio output sockets.

With this job completed, the various items of hardware can be mounted. Begin by fitting the four rubber feet to the corners of the baseplate, then mount the antenna terminals, RCA sockets and power transformer. The wiring diagram shows the general layout inside the chassis.

The main PCB is mounted on 6mm spacers and should be located so that the 75-ohm antenna socket passes through a matching hole in the rear panel. We secured each of the untapped spacers with a nut before installing the PCB. A second set of nuts is then used to secure the board to the stand-offs.

The power supply PCB is mounted on 12mm spacers directly in front of the transformer.

The method of securing the power on/off switch will differ according to the brand of switch. It must be mounted so that the pushbutton knob protrudes the correct disance through the front panel.

In some cases, the switch can be mounted directly on the sub-front panel. In other cases, a mounting bracket may be required to move the switch away from the front sub-panel.

We used a mounting bracket made from fibreglass board material. This was stood-off the sub-front panel using 6mm spacers.

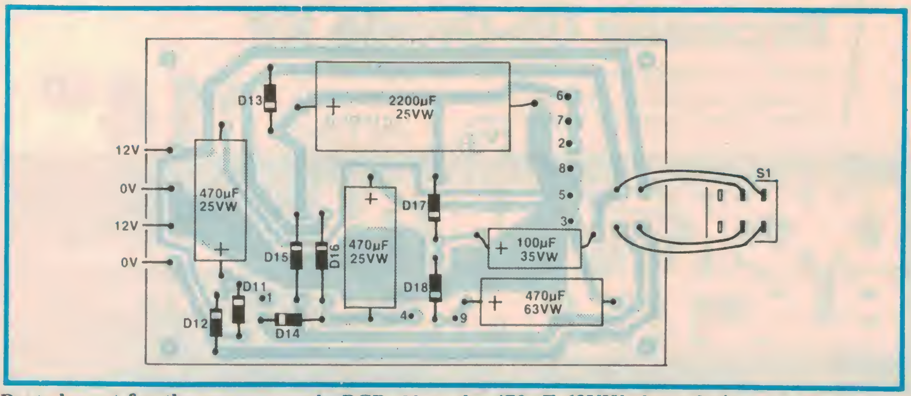
The next step is to mount the display PCB on the sub-front panel using the 12mm standoffs. Note that it may be necessary to use insulating washers between the PCB and standoffs to avoid shorting out the PC tracks. Check this point carefully or you'll strike trouble later on.

The wiring between the display and main PCBs is run using four 8-way cable assemblies. Cut four lengths of 8-way cable — two at 260mm, one at 330mm, and one at 100mm. Separate the ends for 25mm and strip 2mm of insulation from each wire.

The cables can now be connected to the sockets. Insert the cable through the connector socket shell and crimp and solder each wire to the crimp terminals. This done, pull the terminals back into the connector socket.

When the cable assemblies are completed, they can be plugged into the PCB headers. Connect the long cable between the A headers, the two medium length cables between the B and D headers, and the short cable between the C headers.

Check that pin 1 of each header on the main PCB matches up with its corresponding pin 1 on the display PCB.



Parts layout for the power supply PCB. Note the 470μF 63VW electrolytic capacitor.

The display board wiring can now be completed by running a short length of hookup wire from point 11 back to the corresponding point on the main board.

Rear panel wiring

A dual screened cable connects the left and right audio outputs on the main PCB to the output RCA terminals. Note that the cable screen is soldered directly to a PCB stake on the PCB adjacent to the output sockets. From there, a short length of hookup wire also runs to the outer contacts on the RCA sockets (see wiring diagram).

The AM antenna terminals are connected to the main board using short lengths of hookup wire.

Mains wiring

The mains cord passes through the rear panel and is clamped with an in-line cord clamp grommet. The earth wire (green/yellow) is terminated to an earth lug while the active (brown) and neutral (blue) leads are terminated on the transformer pins using bullet connectors. These connectors should be insulated using plastic sleeving.

Scrape away the anodising from around the mounting hole before bolting the earth lug to chassis. This is essential to ensure a good earth contact. Make the earth lead slightly longer than the active and neutral leads so that it will be the last to break if strain is placed on the cord.

The transformer secondary is connected to the power supply PCB using the four leads supplied. Connections to the on/off switch should be run using mains-rated hook-up wire.

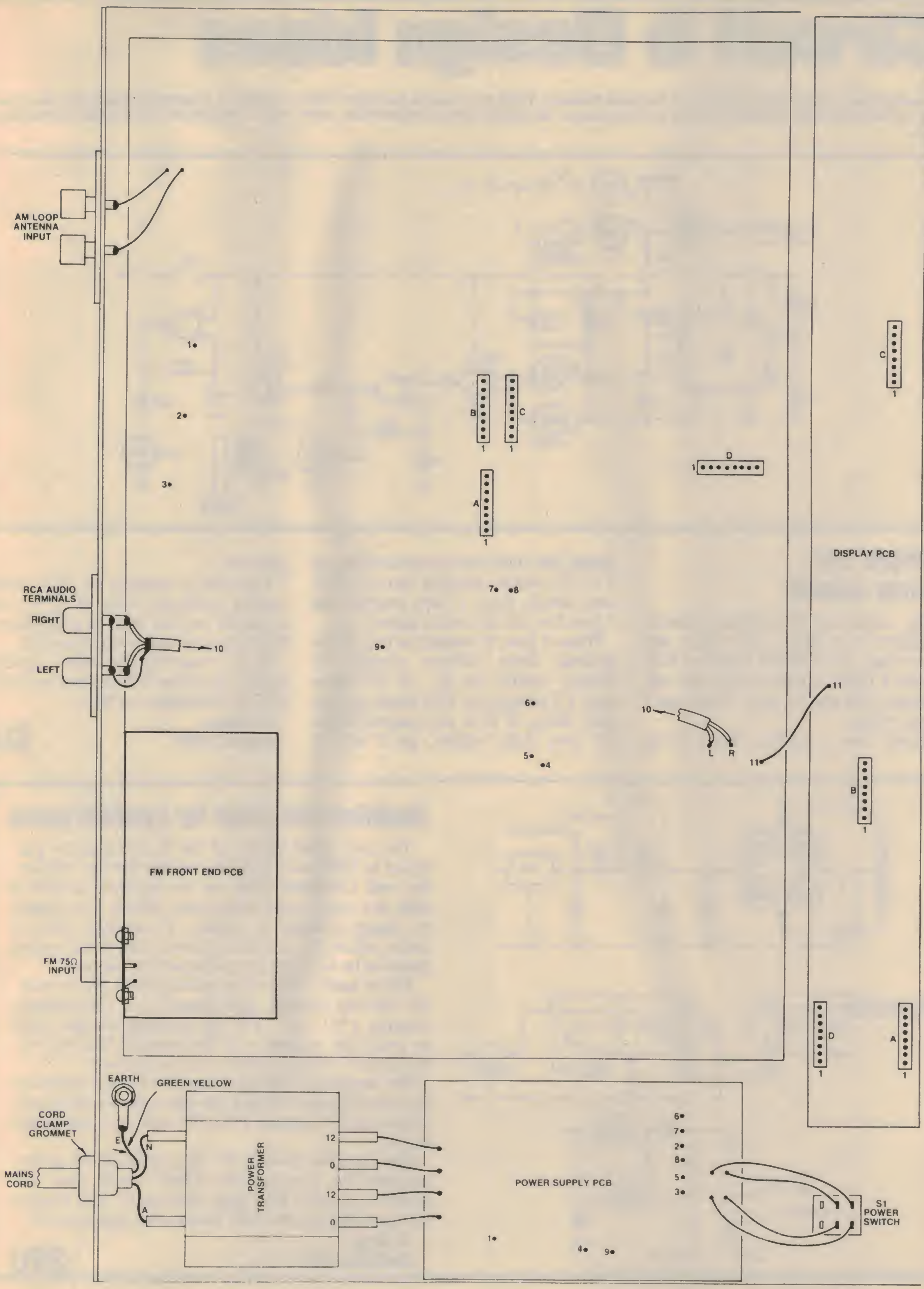
Final assembly

A negative film artwork will be supplied with each kit and this should be affixed to the sub-front panel using double-sided adhesive tape. Position the artwork so that the 7-segment displays and the signal strength meter are all visible.

Finally, the plastic sheet can be fitted to the front panel cutout and the panel bolted to the case. In the prototype, the plastic sheet was held in position by virtue of being a force fit into the panel cutout.

Alternatively, the plastic can be secured by applying a thin film of adhesive to several points along the edges.

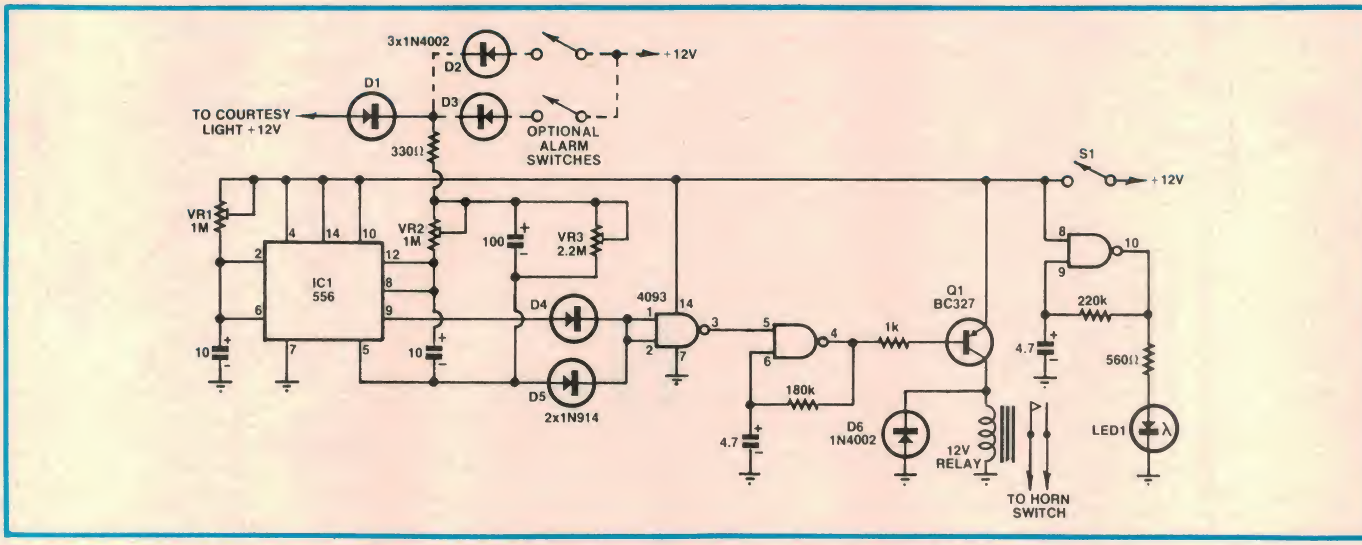
That's all we have space for this month. Next month, we will continue with the alignment details. In the meantime, do not be tempted to switch the unit on as there are a few important points to follow.



AM LOOP
ANTENNA
INPUT
RCA AUDIO
TERMINALS
RIGHT
LEFT
FM FRONT END PCB
FM 75Ω
INPUT
DISPLAY PCB
EARTH
GREEN YELLOW
CORD
CLAMP
GROMMET
MAINS
CORD
POWER
TRANSFORMER
POWER SUPPLY PCB
S1
POWER
SWITCH

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.



Simple car alarm circuit

This simple car alarm circuit features adjustable exit delay, entry delay and alarm time. An oscillator based on IC2c flashes a LED to indicate that the unit is armed and also to deter illegal entry to the vehicle.

Here's how it works. When S1 is closed, the 10μF timing capacitor on pin 6 of IC1 begins charging through VR1 (exit delay). After a short interval, pin 5 goes low and the unit is armed.

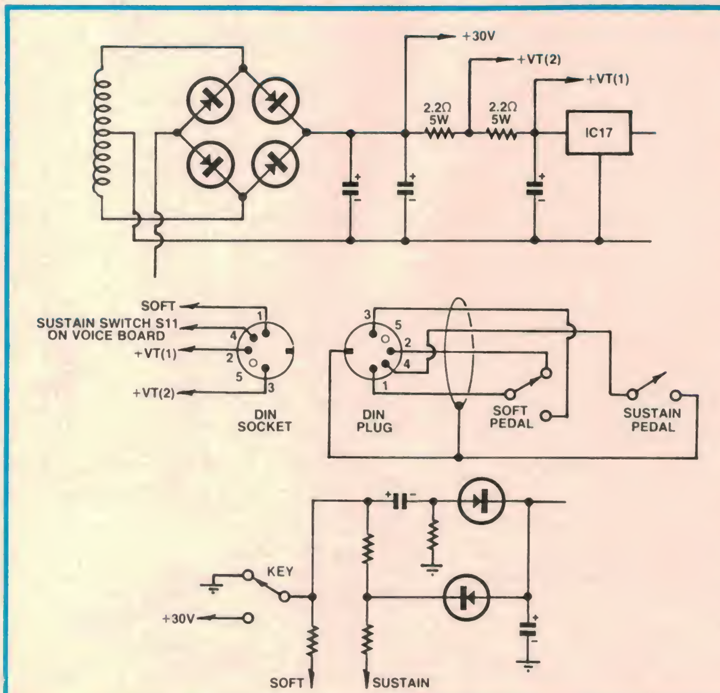
When a door is opened or one of the optional alarm switches tripped, C3 charges rapidly via R1. At the same time, C2 charges via VR2 which sets the entry delay. If S1 is not opened before the entry delay expires, pin 9 of IC1 goes low.

This low is inverted by IC2a which enables oscillator IC2b. IC2b in turn drives Q2 and the relay to pulse the vehicle's horn at half second intervals.

In the event that the door is quickly closed, the alarm will continue to sound until C3 discharges via VR3.

R. Mowe,
Umina, NSW.

$20



Modified soft pedal for Lyrebird piano

The soft pedal circuit of the Lyrebird piano published in *Electronics Australia* during October, November and December 1981 can be improved so that it does not cause notes which have already been played to change abruptly in volume. To simulate the soft pedal action of acoustical pianos, the pedal system needs to be in the keying and envelope circuitry.

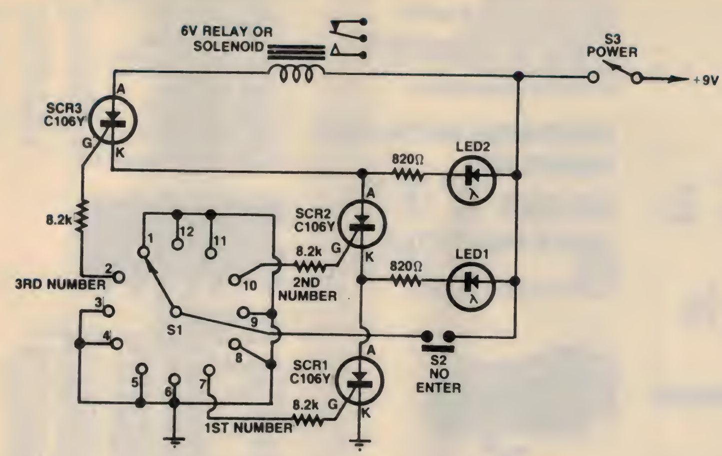
This is easily achieved by splitting the 4.7Ω 5W resistor into two resistors, (for example, 2 x 2.2Ω) thereby creating +Vt1 and +Vt2. By arranging the soft pedal to switch the original +Vt line between Vt1 and Vt2, the desired soft pedal action can be achieved.

The degree of loudness change for the soft pedal can be varied by apportioning the two resistors which substitute for the original 4.7Ω 5W resistor in the power supply.

The two extra leads to the soft pedal can be accommodated by changing the 6.5mm stereo jack and socket to a 5-pin DIN plug and socket. The original soft pedal pin on the voice board is left unconnected.

V. Bien,
Rockdale, NSW

$20



Three-way combination lock

This simple circuit could be used as an electronic lock on a safe or to disarm an alarm system. It uses three silicon controlled rectifiers (SCRs) which have to be triggered in a set sequence.

The numbers are selected using 12-pole rotary switch S1 and entered using momentary contact pushbutton switch S2. When S2 is pressed, either LED 1 or LED 2 will light if the correct number is selected. For example, if position '7' is selected and S2 pressed, SCR1 will turn on and LED 1 will light.

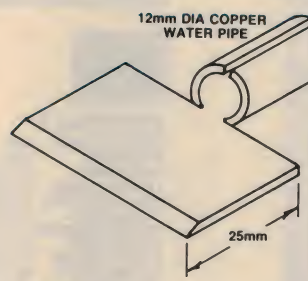
By entering the correct numbers, the SCRs will all be turned on in sequence and the relay activated. In this circuit, the numbers are 7, 10 and 2, but these can easily be changed. If a wrong number is entered, the circuit will automatically cancel the other SCRs.

Note that a numeric keypad could be used instead of the rotary switch. Finally, the security offered by the lock can be increased by increasing the number of SCRs, LEDs and resistors.

J. Kiss,
East Keilor, Vic.

$20

Desoldering tool for ICs



Removing an IC from a PC board can be a difficult task without a solder sucker. That's where this simple tool comes in. It allows you to remove ICs quickly and easily.

All that is required is a heavy-duty soldering iron with a soldering bit of approximately 10mm diameter, and a length of 12mm copper waterpipe.

Cut the pipe so that it is 25mm longer than the soldering iron bit, then cut the pipe lengthwise down one side. This done, cut the pipe nearly through about one inch from one end, open up the 25mm section and flatten.

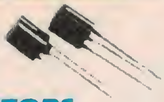
Once flattened, the end can be shaped with a file to give it a chisel shape. It can then be cut to length to suit the IC to be desoldered.

In use, the device is simply clamped around the soldering iron bit and the chisel-shaped end applied to one row of pins on the IC. A small screwdriver can be used to lift the pins clear of the board.

T. Beekman,
Enfield, NSW.

$15

Wanted: Your circuit and design ideas. We pay between $5 and $40 per item published, depending on the merit and how much work we have to do to publish it. The payment of each of the items on these two pages is given as a guide. If you have an original idea, why not send it in to us? Every item received will be acknowledged by mail.



TRANSISTORS

Desc.	10-99	100+	Desc.	10-99	100+
2SJ49	4.50	4.30	2SK134	4.50	4.30
PN2222A	.10	.08	PN2907A	.10	.08
PN3463	.15	.13	PN3565	.12	.11
PN3566	.15	.13	PN3567	.10	.08
PN3569	.18	.16	PN3639	.18	.16
PN3640	.18	.16	PN3641	.10	.08
PN3642	.10	.08	PN3643	.10	.08
PN3644	.15	.13	PN3645	.15	.13
PN4250A	.15	.13	PN4355	.16	.14
PN4356	.16	.14	MPSA42	.23	.20
MPSA43	.23	.20	MPSA55	.15	.14
MPSA56	.15	.14	MPSA92	.22	.20
MPSA93	.22	.20	SC1410	.85	.75
BU126	1.50	1.25	BUX80	2.50	2.20
BU208	2.50	2.20	2SD350	2.75	2.40
BU326	1.95	1.70			

Plus 30% tax where applicable

RCA INSULATING SOCKETS

Cat No.	Desc.	1-99	100+
P10232	2 Way	0.25	0.21
P10234	4 Way	0.45	0.40
P10236	6 Way	0.75	0.60

Plus 30% tax where applicable

RCA CHASSIS MOUNT METAL

Cat No.	1-99	100+
P10231	0.16	0.13

Plus 30% tax where applicable

MINIATURE BUZZER

5-15V White or black.

	10-99	100+
Cat. A15062	0.90	0.80

Plus 20% tax where applicable

ADD ON DISK DRIVE FOR 6502 SYSTEM (APPLE* COMPATIBLE)

1-9	10-24	25+
$150	$140	$130

(*Apple is a registered trademark)

IBM ADD ON HARD DISK

- 10 Mbyte
- Seagate hard disk
- Hard disk controller by Xebec

Cat. X20010 $1295

Plus 20% tax where applicable

MITSUBISHI DISK DRIVES

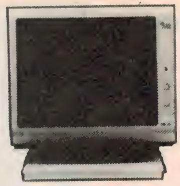
		1-9	10+	25+
4851	5¼"	$160	$150	$140
4853	5¼"	$220	$205	$175
4854	5¼"	$250	$220	$195
2896	8"	$475	$430	$400

Plus 20% tax where applicable

AXIAL ELECTROLYTICS (DOUBLE ENDED)

Cat. No.	Description	10+	100+
R15705	0.47uF 63V	$0.12	$0.10
R15715	1uF 63V	$0.12	$0.10
R15725	2.2uF 63V	$0.12	$0.10
R15742	4.7uF 25V	$0.11	$0.09
R15745	4.7uF 63V	$0.11	$0.09
R15761	10uF 16V	$0.12	$0.10
R15762	10uF 25V	$0.13	$0.12
R15765	10uF 63V	$0.15	$0.14
R15792	22uF 25V	$0.13	$0.12
R15794	22uF 50V	$0.17	$0.15
R15812	25uF 25V	$0.13	$0.12
R15815	25uF 63V	$0.17	$0.15
R15831	47uF 16V	$0.16	$0.13
R15832	47uF 25V	$0.16	$0.13
R15835	47uF 63V	$0.22	$0.19
R15841	100uF 16V	$0.18	$0.16
R15842	100uF 25V	$0.18	$0.16
R15845	100uF 63V	$0.27	$0.24
R15851	220uF 16V	$0.17	$0.15
R15852	220uF 25V	$0.21	$0.18
R15855	220uF 63V	$0.50	$0.46
R15871	470uF 16V	$0.27	$0.24
R15872	470uF 25V	$0.29	$0.27
R15873	470uF 35V	$0.75	$0.70
R15875	470uF 63V	$0.75	$0.70
R15885	1000uF 63V	$0.60	$0.58
R15891	1000uF 16V	$0.39	$0.35
R15892	1000uF 25V	$0.45	$0.40
R15893	1000uF 35V	$0.70	$0.65
R15894	1000uF 50V	$0.00	$0.00
R15903	2200uF 35V	$1.20	$1.10
R15904	2500uF 50V	$1.30	$1.20
R15911	2500uF 16V	$0.59	$0.50
R15912	2500uF 25V	$0.95	$0.90
R15913	2500uF 35V	$1.10	$1.00
R15914	2500uF 50V	$1.30	$1.20
R15932	4700uF 25V	$1.90	$1.80
R15933	4700uF 35V	$2.40	$2.15

Plus 30% tax where applicable



RITRON II

Swivel base monitor in stylish case.

	1-9	10+	50+
Green Cat. X14506	$145	$135	$115
Amber Cat. X14508	$150	$140	$120

Plus 20% tax where applicable

MONITORS

Cat No.		1-3	4+
X14500	Ritron 1 Green	$130	$125
X14502	Ritron 1 Amber	$135	$130

BACK IN STOCK

Plus 20% tax where applicable

CERAMICS 50V PERIOD

	100+	500+
1pF - 2.2nF	$2.20	$2.00
3.3nF - 10nF	$2.50	$2.20
22nF - 47nF	$2.90	$2.70
100nF	$7.00	$6.50
220nF	$9.50	$8.50
330nF	$12.00	$11.00

Plus 10% tax where applicable

ELECTROLYTIC SINGLE ENDED PCB MOUNT

Cat. No.	Descr.	10+	100+
R15405	0.47uF 63V	$0.07	$0.06
R15415	1uF 63V	$0.07	$0.06
R15422	2.2uF 25V	$0.07	$0.06
R15424	2.2uF 50V	$0.06	$0.05
R15425	2.2uF 63V	$0.07	$0.06
R15432	3.3uF 25V	$0.07	$0.06
R15435	3.3uF 63V	$0.07	$0.06
R15442	4.7uF 25V	$0.07	$0.06
R15443	4.7uF 35V	$0.08	$0.07
R15445	4.7uF 63V	$0.07	$0.06
R15461	10uF 16V	$0.07	$0.06
R15462	10uF 25V	$0.07	$0.06
R15463	10uF 35V	$0.07	$0.06
R15465	10uF 63V	$0.07	$0.06
R15481	22uF 16V	$0.07	$0.06
R15482	22uF 25V	$0.30	$0.25
R15483	22uF 35V	$0.08	$0.07
R15484	22uF 50V	$0.09	$0.08
R15502	25uF 25V	$0.07	$0.06
R15505	25uF 63V	$0.10	$0.08
R15512	33uF 25V	$0.08	$0.07
R15521	47uF 16V	$0.09	$0.08
R15522	47uF 25V	$0.09	$0.08
R15525	47uF 63V	$0.10	$0.09
R15531	100uF 16V	$0.10	$0.09
R15532	100uF 25V	$0.08	$0.07
R15533	100uF 35V	$0.15	$0.12
R15535	100uF 63V	$0.24	$0.22
R15541	220uF 16V	$0.09	$0.08
R15542	220uF 25V	$0.14	$0.12
R15543	220uF 35V	$0.25	$0.23
R15545	220uF 63V	$0.26	$0.24
R15552	330uF 25V	$0.15	$0.13
R15555	330uF 63V	$0.34	$0.30
R15561	470uF 16V	$0.16	$0.13
R15562	470uF 25V	$0.23	$0.20
R15563	470uF 35V	$0.30	$0.28
R15564	470uF 50V	$0.00	$0.00
R15565	470uF 63V	$0.44	$0.39
R15581	1000uF 16V	$0.25	$0.22
R15582	1000uF 25V	$0.35	$0.30
R15583	1000uF 35V	$0.45	$0.40
R15591	2200uF 16V	$0.45	$0.40
R15592	2200uF 25V	$0.65	$0.60
R15593	2200uF 35V	$1.20	$0.91
R15601	2500uF 16V	$0.45	$0.40
R15602	2500uF 25V	$0.65	$0.60

Plus 10% tax where applicable

NOW AVAILABLE!
50 Page wholesale price list
Please call in or write to:
P.O. Box 620, CLAYTON 3168
and simply supply a business card!

UNPROTECTED STRIP HEADERS

Dual in Line 2.54mm

	1-9	10+
P12240 10 Way Unprot Header	1.25	1.10
P12246 16 Way Unprot Header	1.35	1.20
P12250 20 Way Unprot Header	1.45	1.25
P12256 26 Way Unprot Header	1.50	1.40
P12260 30 Way Unprot Header	1.75	1.65
P12264 34 Way Unprot Header	1.95	1.75
P12270 40 Way Unprot Header	2.25	1.95
P12275 50 Way Unprot Header	2.75	2.50
P12280 60 Way Unprot Header	2.95	2.75

Plus 20% Sales Tax where applicable

RESISTORS

¼ WATT E12 CARBON BULK
PACKED $5.25/1000
TAPED AND BOXED $5.25/1000
$5.00/1000 10K LOTS
¼ METAL FILM TAPED AND BOXED
$12.00/1000 $11.00/1000/10K LOT
SUPPLY E24 VALUE
Plus 30% tax where applicable

VERBATIM DATA LIFE DISKETTES

		10-99	100+	500+
SS/DD	MD525-01	2.50	2.35	2.25
DS/DD	MD550-01	3.20	2.50	2.40

XIDEX DISKETTES

SS/DD	2.50	2.50	2.25
DS/DD	3.40	3.05	2.85

Plus 20% tax where applicable

HORN SPEAKERS

Cat No.		1-99	100+
C12010	5" Plastic 10W Max	4.80	4.70
C12015	5" Metal 10W Max	4.70	4.60
C12012	12V Siren	8.50	8.00

Plus 20% tax where applicable

MONOLITHIC .1uF 50V

10+	100+	1000+
$0.09	$0.07	$0.06

Plus 20% tax where appiicable

GREY FLAT RIBBON CABLE

			PER 100 FT ROLL			
Cat No.	Desc.	Per Mtr	1-3	4-9	10-99	100+
W12614	14 Way	1.29	19.50	18.50	18.00	14.00
W12616	16 Way	1.90	21.50	19.50	19.00	16.00
W12620	20 Way	2.20	29.50	28.00	26.50	20.00
W12625	25 Way	2.50	32.50	29.00	28.50	25.00
W12626	26 Way	2.60	34.00	32.00	29.00	26.00
W12634	34 Way	2.80	44.00	42.00	39.00	34.00
W12636	36 Way	3.00	49.00	47.00	42.50	36.00
W12640	40 Way	3.20	55.00	52.50	49.50	40.00
W12650	50 Way	3.75	62.00	59.50	58.50	50.00

EX STOCK
LARGER QUANTITIES NEGOTIABLE
Plus 20% tax where applicable

CRYSTALS

Cat No.	Frequency	Can	10+	100+	500+	1000+
Y11000	1MHz	HC33	5.50	4.75	4.50	4.00
Y11005	2MHz	HC33	2.25	1.95	1.85	1.70
Y11008	2.4576MHz	HC18	2.25	1.95	1.85	1.70
Y11015	3.57954MHz	HC18	1.20	.90	.65	.60
Y11020	4.00MHz	HC18	1.30	.90	.75	.60
Y11022	4.194304MHz	HC18	1.40	.90	.75	.60
Y11025	4.75MHz	HC18	1.40	.90	.75	.60
Y11026	4.9152MHz	HC18	1.40	.90	.75	.60
Y11042	6.144MHz	HC18	1.40	.90	.75	.60
Y11050	8.00MHz	HC18	1.40	.90	.75	.60
Y11055	8.867238MHz	HC18	1.40	.90	.75	.60
Y11070	12.00MHz	HC18	1.40	.90	.75	.60
Y11072	14.318MHz	HC18	1.40	.90	.75	.60
Y11080	16.00MHz	HC18	1.40	.90	.75	.60
Y11085	18.432MHz	HC18	1.40	.90	.75	.60
Y11090	20.00MHz	HC18	1.40	.90	.75	.60

FULL RANGE OF CRYSTALS AVAILABLE ON INDENT
Plus 20% tax where applicable

POLYESTER 100V "GREENCAP" TYPE

Cat No.		1-99	100+	1000+
R15131	.001uF	0.06	0.04	.036
R15137	.0012uF	0.06	0.04	.036
R15138	.0015uF	0.06	0.04	.036
R15140	.0022uF	0.06	0.04	.036
R15142	.0033uF	0.06	0.04	.036
R15143	.0039uF	0.06	0.04	.036
R15145	.0047uF	0.06	0.04	.036
R15146	.0056uF	0.06	0.04	.036
R15147	.0082uF	0.06	0.04	.036
R15148	.01uF	0.07	0.05	.045
R15150	.015uF	0.07	0.05	.045
R15152	.022uF	0.07	0.05	.045
R15154	.033uF	0.07	0.05	.048
R15155	.039uF	0.07	0.05	.045
R15156	.047uF	0.08	0.06	.055
R15157	.056uF	0.08	0.06	.055
R15158	.068uF	0.08	0.06	.055
R15159	.082uF	0.08	0.07	.055
R15160	.1uF	0.09	0.08	.07
R15162	.15uF	0.11	0.10	.09
R15164	.22uF	0.15	0.14	.13
R15165	.27uF	0.16	0.15	.14
R15172	1uF	0.70	0.55	0.50
R15176	2.2u	1.20	1.10	1.00
R15178	3.3uF	1.50	1.20	

Plus 30% tax where applicable

COMPUTER CONNECTORS

Cat No.	Description	1-99	100+	1000+
P10900	DB25 Plug	1.30	1.20	1.00
P10901	DB25 Socket	1.40	1.30	1.20
P12210	Centronics Solder	3.50	3.15	2.50
P12200	Centronics Crimp	6.00	5.50	5.00
P10880	DB9 Plug	1.30	1.20	0.90
P10881	DB9 Socket	1.40	1.30	1.00
P10890	DB15 Plug	1.30	1.20	0.90
P10891	DB15 Socket	1.40	1.30	1.00
P10902	DB25 Cover	.80	.65	.55

Plus 20% tax where applicable

MEMORY

"Check for the latest memory prices!"

	10-99	100+	1000+	10K+
4164-15P	$2.00	$1.50	$1.30	$1.10
41256	$7.00	$6.00	$5.50	$5.00
6116P-3	$3.00	$2.90	$2.00	$1.80
2716	$4.90	$4.50	$4.25	$4.00
27128	$5.00	$4.50	$4.00	$3.50
2532	$7.50	$6.50	$6.40	$6.30
2732	$6.50	$6.10	$5.90	$5.50
27256	$29.00	$27.00	$22.00	19.00
6264	$5.50	$5.00	$4.50	$4.00

Plus 20% tax where applicable

IC's GALORE!

	1-9	10+	100+	250+
8035	3.90	3.70	3.50	3.00
8085	4.00	3.90	3.50	3.00
8088	19.00	18.00	15.00	14.00
8155	3.90	3.75	3.50	3.00
8156	3.50	3.30	2.90	2.50
8212	1.90	1.70	1.50	1.00
8224	2.40	2.00	1.90	1.50
8226	1.90	1.70	1.50	1.00
8237A	35.00	31.00		
8253	3.90	3.70	3.50	3.00
8255	4.00	3.50	2.90	2.00
8257	3.90	3.50	3.00	2.50
8259	3.90	3.50	3.30	2.70
8237A	35.00	31.00		
8279	3.90	3.50	3.30	2.70

Plus 20% tax where applicable

LOW PROFILE IC SOCKETS

How cheap can they go ??

	10+	100+	1000+	10K
8 Pin	.08	.07	.06	.05
14 Pin	.10	.09	.08	.07
16 Pin	.11	.10	.09	.08
18 Pin	.12	.11	.10	.09
20 Pin	.13	.12	.11	.10
22 Pin	.14	.13	.12	.11
24 Pin	.15	.14	.13	.12
28 Pin	.19	.17	.15	.14
40 Pin	.25	.24	.22	.20

Plus 20% tax where applicable

VOLTAGE REGULATORS

	10+	100+	1000+
7805uC	.45	.44	.43
7805KC	1.50	1.40	1.20
7812uC	.45	.44	.43
7815KC	1.50	1.40	1.20
7818uC	.50	.49	.48
7818KC	1.50	1.40	1.20
7905uC	.70	.60	.55
7912uC	.70	.60	.55
uA323KC	4.50	3.90	3.75
78H12	7.00	6.00	5.90
78HGKC	7.50	6.50	6.00
79HGKC	16.50	16.00	14.00
78P05	11.50	11.00	10.50
78P12	14.00	13.50	13.00

Plus 20% tax where applicable

BRIDGES

	10+	100+	1000+	10K+
6A 400V	1.00	0.80	0.75	0.69
W02	0.24	0.23	0.20	0.18
W04	0.25	0.24	0.21	0.19
NEW MDA3504 BRIDGE!				
35A 400V	3.50	2.90	2.75	2.50

Plus 20% tax where applicable

IDC SOCKETS

	1-9	10+	100+
P12100 10 Pin Socket	1.95	1.75	1.25
P12101 16 Pin Socket	2.25	2.05	1.65
P12102 20 Pin Socket	2.45	2.25	1.90
P12104 26 Pin Socket	2.65	2.45	2.00
P12106 34 Pin Socket	2.75	2.55	2.15
P12108 40 Pin Socket	2.95	2.75	2.25
P12110 50 Pin Socket	3.50	2.95	2.50

Plus 20% Sales Tax where applicable

IDC CONNECTORS

		1-99	100+
P12114	14 Pin Dip Plug	0.80	0.75
P12116	16 Pin Dip Plug	0.75	0.70

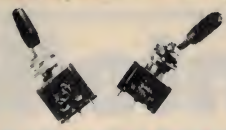
Plus 20% tax where applicable

NEW SWITCHES

Right angle P.C.B. mounting

	10-99	100+
SPDT Cat. S11040	1.00	.95
DPDT Cat .S11042	1.20	1.00

Plus 20% Sales Tax where applicable



ECONOMY TOGGLE SWITCHES

Unbelievable Value!

	10-99	100+
S11010 (SPDT)	0.70	0.60
S11020 (DPDT)	0.90	0.80

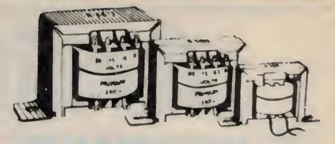
Plus 20% Sales Tax where applicable

19" RACK MOUNT CASE

Tremendous value! Vented.
Dimensions: 480(W) x 134(H) x 250(D)mm.

1-9	10+
$32.00	$29.50

Plus 20% tax where applicable



TRANSFORMERS

Cat No.		1-99	100+	1000+
M12851	2851	2.50	2.25	1.90
240V 12-6V CT 150mA				
M12155	2155	4.80	4.10	3.70
240V 6-15V 1A tapped				
M12156	2156	6.35	6.15	5.95
240V 6-15V 2A tapped				
M16672	6672	6.35	6.15	5.95
240V 15-30V 1A tapped				

Plus 20% tax where applicable

NEW TRANSFORMER!

M12860	2860	3.00	2.50	2.20

240V to 15V C.T. at 250mA
Plus 20% tax where applicable

TANTALUM CAPACITORS

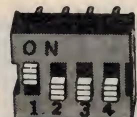
Cat. No.	Description	10+	100+
R16124	4.7uF 16V	$0.24	$0.18
R16125	10uF 16V	$0.25	$0.23
R16126	15uF 16V	$0.38	$0.36
R16128	22uF 16V	$0.42	$0.40
R16132	47uF 16V	$1.55	$1.20
R16134	68uF 16V	$1.80	$1.50
R16220	4.7uF 16V	$0.35	$0.33
R16224	10uF 16V	$0.38	$0.37
R16228	22uF 16V	$1.20	$1.00
R16300	0.1uF 16V	$0.13	$0.12
R16302	0.15uF 16V	$0.13	$0.12
R16304	0.22uF 16V	$0.15	$0.12
R16306	0.33uF 16V	$0.15	$0.14
R16308	0.47uF 16V	$0.15	$0.14
R16310	0.68uF 16V	$0.16	$0.15
R16311	0.82uF 16V	$0.18	$0.15
R16312	1uF 16V	$0.15	$0.12
R16314	1.5uF 16V	$0.24	$0.20
R16316	2.2uF 16V	$0.24	$0.23
R16318	3.3uF 16V	$0.29	$0.27
R16320	4.7uF 16V	$0.35	$0.33

30% Sales tax where applicable

QUALITY MOMENTARY (RED BODY)

	10-99	100+
SPDT Cat. S11050	1.00	.90

Plus 20% Sales Tax where applicable



DIP SWITCHES

	10+	100+	1000+
S13402 2 Way	.70	.65	.60
S13404 4 Way	.80	.75	.70
S13405 5 Way	.90	.85	.80
S13407 7 Way	1.10	1.00	.95
S13408 8 Way	1.20	1.10	1.00

20% Sales tax where applicable

"BEAT THE DOLLAR DEVALUATION WITH RITRONICS WHOLESALE!"

HOOK UP WIRE

Cat. No.	Description
W11251	13/.12 TND BLK
W11252	13/.12 TLD BROWN
W11253	13/.12 TLD ORANGE
W11254	13/.12 TLD YELLOW
W11255	13/.12 TLD GREEN
W11256	13/.12 TLD BLUE
W11257	13/.12 TLD WHITE

PRICES PER 100 METRE ROLL

1-9	10+
$3.50	$3.00

Plus 20% tax where applicable

W11260 14/.20 RED
W11261 14/.20 BLACK
W11265 14/.20 BLUE
W11268 14/.20 WHITE

PRICES PER 100 METRE ROLL

1-9	10+
$9.00	$7.00

Plus 20% tax where applicable

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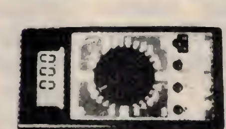

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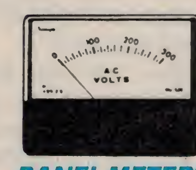

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Q10510	MU45 0-5A	6.95	6.75	6.50
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Q10535	MU45 VU	7.95	7.75	7.50
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Q10538	MU65 0-50uA	9.35	8.95	8.75
Q10540	MU65 0-1mA	9.35	8.95	8.75
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Artificial intelligence

FORUM

Conducted by Neville Williams

Once considered impossible, the idea of artificial intelligence has gained credibility of late, to the point where it is now commonly assumed to be "just around the corner". Today the super-computer; tomorrow an intelligent, thinking, "humanoid" electronic brain. Now seems as good a time as any to question and debate that much too facile assumption.

I'd been considering, for some time, the idea of discussing the matter and, in the wake of a "Beyond 2000" TV program on artificial intelligence, it needed only a phone call from a technical friend to get me started. If I can condense his observations into a few formal paragraphs, they would translate into something like this:

You've talked about many topics in "Forum" over the years but I can't recall any discussion of "intelligent computers" or "electronic brains" — both very questionable concepts, to my way of thinking.

Not so long ago, technical writers were fond of branding calculators and computers as "electronic morons" — adept at what they had been programmed to do, but devoid of other initiatives. More ambitious computers and programs notwithstanding, I don't see that the situation has changed all that much.

Yet, nowadays, the latest typewriters, terminals and other whatnots are repeatedly described as "intelligent", while family cars are not considered modern unless their various functions are monitored by an on-board "electronic brain".

As for computers, periodic advances in chip capacity, speed and architecture tend to be interpreted by feature writers as steps towards that automatic and ultimate goal: an intelligent, reasoning replica of the human brain!

If the human brain was simply an organic repository and process of formalised information, the idea mightn't be too far-fetched. What the writers conveniently overlook is that the human brain gathers, correlates, interprets and communicates such information by means of senses and faculties which computerised contrivances can as yet imitate in only the most primitive fashion — even if at all.

They are flat out coping with a limited vocabulary of spelled-out words, let alone with often poorly organised and poorly vocalised ideas, unclear pronunciation, ambiguities, inflection, emphasis, gestures and so on — familiar elements of everyday conversation, which even a child soon learns intuitively to cope with.

Again, the human brain is subject to a variety of complex emotions; it imposes constraints which we broadly categorise as morality and/or conscience, and responds to religious, super-natural or spiritualistic stimuli of an arguably non-physical nature.

While a computer design team may choose to discard such qualities as too-hard, inappropriate, spurious or redundant, the fact remains that a supposedly "intelligent" electronic "brain" without them would be reminiscent more of science fiction's Mr Spock, than of authentic terrestrial mortals!

For sure, the technological achievements of the computer industry are mind-boggling but please: a little more realism as to where we are at and in which direction we are headed.

Maybe we need some new words in our language or more discerning use of the old ones to counter some of the current speculation, misinformation and misunderstanding as to what computers are all about.

M. N.
(Thornleigh, NSW)

Thanks M.N. for your timely and interesting contribution.

I guess that most of us are aware of the description "moron", as applied to a calculator or computer. Faced with their speed and accuracy, compared with our own often sluggish mental responses, it can be reassuring, in a negative kind of way, to draw attention to their otherwise limited initiative and "think" power.

But, with the ever expanding capabilities of computer based equipment, the "moron" tag has become progressively less convincing even if, as M.N. maintains, it is still strictly true. How can something so adept still be a moron?

Marketing and advertising people certainly find no difficulty, these days, in boasting to good effect about their company's "smart" or "intelligent" whatnots, as a way of dramatising the advantages of new models compared with the old.

"Smart" is a fairly neutral term but "intelligent", and other words sharing the same root, have long-standing connotations linking them firmly with the human brain. Look them up in an older dictionary and you'll see what I mean:

INTELLECT: That mental faculty which receives ideas; the understanding; mental power; the mind.
INTELLIGENCE: The capacity to know; an intelligent or spiritual being.
INTELLIGENT: Endowed with the faculty of understanding or reason; endowed with a good intellect; well informed.

To a person with that kind of verbal conditioning, talk of an "intelligent computer" may very easily be assumed to mean one which exhibits basic characteristics resembling those of a human intellect (or mind or brain) — certainly an intriguing notion but one that owes more to promotional hype than to reality at this point in time.

Unfortunately, it is difficult to suggest alternative terms which are free of the "human" connotation. Short of inventing new words, we have little choice but to broaden by usage the meaning of the old ones — a familiar trick in the English language.

In fact, this has already occurred with "intelligence" and "intelligent", as reference to the Macquarie Dictionary will show. (Not so for "Brain", which is

— Who's kidding whom?

still defined only as: "the soft, convoluted mass of greyish and whitish nerve substance which fills the cranium of man and other vertebrates.")

INTELLIGENCE: 1. capacity for understanding and for other forms of adaptive behaviour; aptitude in grasping truth, facts, meaning, etc . . . 8. the capacity which a computerised machine derives from programs built into it to recognise specified conditions and perform non-constant functions independently of an operator.

INTELLIGENT: 1. having a good understanding of mental capacity; quick to understand as persons or animals. . . . 4. of or pertaining to a computerised piece of machinery which is programmed to recognise specific sets of conditions and to carry out non-constant functions independently of an operator.

Those two definitions, at least, fit in with M.N.'s call for "more discerning use" of established words. But they also support his observation that more ambitious hardware and software notwithstanding, "the situation hasn't changed all that much".

Modern computers and "computerised machines" can certainly access, process and respond to vastly more data than once was possible. They can make more complex decisions and control more complex functions but their areas of expertise are still "specific" and still need to be organised and programmed by humans.

In short, they're still "electronic morons", although they are impressively capable morons!

"Brains" ain't brains!

For reasons such as those suggested by M.N., there is far more to simulating a real human intellect or brain than the revolutionary architecture and the copious high-speed memory and logic that characterises even the latest and much vaunted "5th generation" computers.

Merely to upgrade their sensing and communication potential to anything like human standards would provide scope for research projects, these and doctorates, for years to come. As one authoritity remarked in "Beyond 2000": for all practical purposes, today's best computers are still "blind, deaf, mute and passive!"

Beyond that would lie the job of researching and defining the complex emotions, foibles, passions and convictions of a human mind, and translating them into credible behavioural programs capable of being superimposed on whatever else is fed into the artificial "brain".

(That leads, incidentally, to the notion of deliberately accentuating certain "emotions, foibles, passions and convictions" to recreate one's own hypothetical Hitler or Schweitzer — surely the ultimate in academic "games"!)

That aside, the task ahead of a scientist aspiring to create a humanoid brain might be summed-up by a proposition credited to computer pioneer Alan Turing: that a "computer machine" at the far end of a telephone line would qualify as "intelligent" if its spoken responses to ordinary conversation could not be distinguished from those of a human being.

That sort of electronic brain is not just around the corner; it's a long way down the track! And while it may exist as a hypothetical goal, it does so on the basis that: if we can accomplish that, we will have established our ability to do other things with more immediate applications.

Non-humanoid brains:

For the present, the more practical and useful artificial brain will be (or is) of a candidly and deliberately non-humanoid variety; capable of being programmed to accommodate and interact with a mass of structured information relating to some specific field, but unaffected by lapses of memory, mental "indigestion", emotions, prejudice, oddball reactions and other human traits.

In so saying, I may appear to have completed the full circle back to a sort of "Spock machine" — an electronic brain installation into which one could feed suitably organised information on specific subjects and have it evaluated quickly, accurately and dispassionately.

I jest, of course, but something akin to my "Spock machine" is already emerging in the guise of "expert" computer systems — a less colourful description than "intelligent" but one that is more appropriate and less likely to be exploited and misunderstood.

An "expert" system might be defined as one which can be programmed to analyse and correlate information in much the same way as would human experts, except that the expert system can arrive at the answer dispassionately and much more speedily.

In "Beyond 2000", Dr Trevor Pearcy of the Chisholm Institute of Melbourne explained an expert system as a "tool to aid our own thinking".

Indeed, that's what came through in the program, despite a certain preoccupation with ultimate humanoid "intelligence". Expert systems were shown being programmed and used in environmental, medical and military situations, to perform tasks — in this case process data —at the behest of humans, more effectively than they could do unaided.

I guess that's true of just about any "tool" from a stone-age axe onwards. Essentially, the so-called "5th generation" computers offer a better kind of axe than the ones we've had to date. They'll also be much more expensive, leading to the billion dollar commercial heart of the matter: whether they'll be purchased from American, European or Japanese consortia!

Incidentally, if the term "expert" is still not to your liking, an alternative industry buzzword is the acronym IKBS, short for "Intelligent Knowledge-Based System". It does, of course, reintroduce

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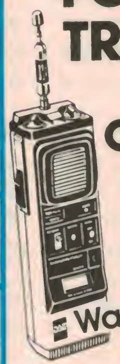

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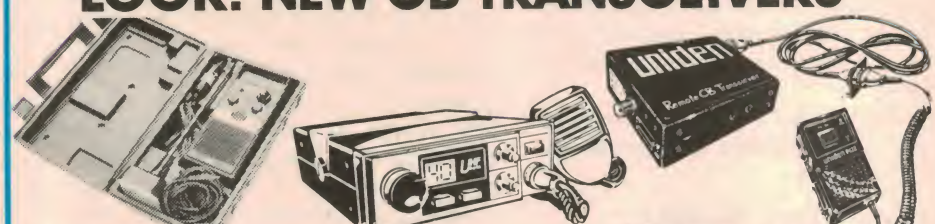

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B.110/RB

that ambiguous word "intelligent" but only a machine could ever be thought of as an IKBS!

You don't like IKBS either? Well, I noticed the title "Personal Sequential Inference Processor" on the panel of one of the Japanese 5th generation pilot production models. So how about a PSI?

PA system "catastrophe"

By way of a complete change of subject, a reader from Canberra recounts a tale of woe involving a public address system, which would have to be a classic case of "red faces all around". I suggest you read his letter in the accompanying panel.

While I've had only limited experience with FM radio (or "wireless") mics, my initial reaction was simply to agree with the writer's diagnosis and to leave it at that.

But on reflection I soon realised that, in everyday situations, speakers typically enjoy considerable freedom of movement without anything like the trauma described by R.B. His had to be a special case.

From what I've observed, much the greater risk is that of the person wearing the microphone inadvertently straying too close to the loudspeaker system and causing acoustic feedback. They quickly learn not to do it again!

My tip is that R.B.'s problem did have to do with an RF peak/null situation as described but that it was aggravated by insufficient signal strength to begin with. This could have resulted from lower than normal RF output from the particular mic transmitter or perhaps low battery voltage, such that the system simply could not cope with any further loss of level.

The end result would be reminiscent of the dropouts that occur in FM reception when one is driving near the fringe of the station coverage.

In this context, it should be pointed out that, with a lower than normal signal level, the setting of the receiver muting becomes quite critical. If set too fine, a burst of noise may be heard when the incoming signal is severely reduced or interrupted. If set too far the other way, the receiver may mute prematurely and interrupt an otherwise acceptable signal.

R.B. does not mention the type of receiver or tuner being used with the microphones but I do wonder whether the muting level had something to do with the magnitude of his problem.

One other point worth mentioning is that not all wireless mics are as stable as they should be in terms of frequency, being sensitive in some cases to the "dress" of the antenna. A shift in frequency with each movement of the speaker can produce not only a variation in the level of the signal, as received, but also a sharp rise in distortion.

One other point in R.B.'s letter invites comment, namely his reference to the speaker's voice going "soft" as distinct from "silence".

Whereas silence would be accounted for by complete signal dropout, going soft could suggest that the speakers were also falling foul of another characteristic of lapel or necktie microphones.

For sure, you can't walk away from them but you can turn the head aside, or shadow them with a hand or arm, or knock them askew. Particularly in marginal situations, a loss of level or a loss of treble response from such causes can seriously reduce intelligibility.

Like other microphones, the clip-on variety have their uses — and their abuses!

R.B. suggests in closing that other readers may like to recount similar stories of P.A. system experiences and catastrophies. A good suggestion R.B.; it could undoubtedly provide some diverting reading.

Problems with a "wireless" microphone

Dear Mr Williams,

Thanks for the article "A guide to correct microphone usage". It prompts me to relate a tale of woe which other readers may find interesting.

Some months ago, I ran a public speaking contest for Toastmasters, an amateur (but not novice) organisation which teaches and promotes public speaking (no mumbling, etc). In this case, the contestants had to address an audience of about 300 people.

The hall was fitted out with a 4-channel audio system, fed from two cable mics and two FM radio mics (each feeding a separate FM receiver). In turn, the amplifier fed a column loudspeaker in each corner of the hall, which was very "live" because of the polished wooden floor and long refectory tables.

One radio mic was a hand-held type (for business sessions), the other being a lapel unit for the competition speakers. On the first night of the contest, the mics were checked out before the arrival of the audience, levels were set and all seemed well.

In due course, the hall filled to capacity and the meeting was called to order on the roving radio mic, with no hint of any problem.

The first contestant clipped on his lapel radio mic and proceeded to speak. His voice rang out clearly . . . then silence . . . boomed out again . . . went soft . . . and so on. It sounded like an intermittent loss of amplifier gain but other nervous speakers seemed oblivious of the fault. The contest was a disaster!

The gear was tested next morning and worked much as it had done during the initial checkout. And therein lies the rub. During that initial check, we hadn't been looking for barely perceptible changes in volume, but they were there.

What had happened was apparently this: The distance from the mic to the receiver was a couple of dozen (radio) wavelengths. When the contestant stepped back, the RF signal went from adequate strength to a null. The difference may have amounted to only a few dB and, in the empty hall, with lots of audio (and some radio) reflections, the loss was barely discernible. But, with the hall full of energy absorbing bodies, the radio and audio loss was catastrophic.

In the case of a speaker gripping a lectern, or TV interviewees glued to a chair, a radio mic serves the speaker well; he/she can't move. But, for a speaker who takes a step back to emphasise a point, a radio mic can let them down badly.

Maybe other readers may be able to recount similar P.A. system catastrophies.

R.B. (Canberra, ACT).

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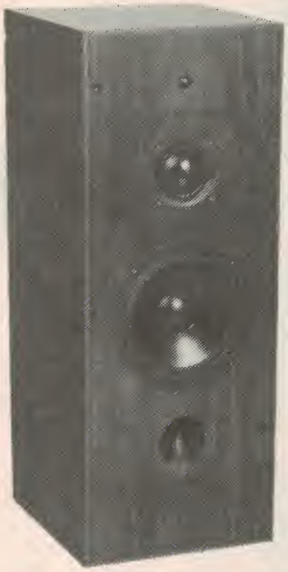

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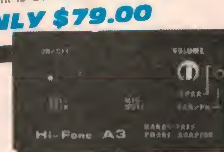

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NEW AM-STEREO/FM-STEREO WIDE BAND TUNER

Ref: EA Dec/Jan onwards

What can I say - it's a world beater. If you want THE BEST at any price. We will not have the kit in stock in January (due to metalwork delays over Xmas) but it should be available mid-end Feb.
Cat. KA-1635 INTRODUCTORY PRICE
$399 COMPLETE *Remote extra.*

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Ref: EA August 1985 - measure from 1pF to 99.9uF with this handy piece of equipment.
Cat. KA-1595
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See AEM magazine in August

TWEETER D25TG Cat. CT-2020
$59.95 ea $119/pair
WOOFER P21WO Cat. CW-2132
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TOTAL PRICE $557.90
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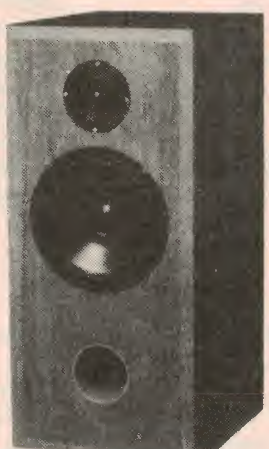
SAVE $58.90!!



Complete wooden cabinet kit. Black vinyl sides, "woodgrain" texture with matching grey baffle screen, port tube etc.

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Only $148 per pair!

☆ ☆ NEW ☆ ☆ Motor/Gearbox Kit

This fantastic new kit enables you to produce a shaft speed between 3 and 2,000 RPM!
It uses a small DC motor with a 'modular' gearbox attached. You are supplied with gear wheels, spacers etc to configure your gearbox to almost any speed within the 3-2,000 RPM range. Measures only 48(H) x 25(W) x 37(D)mm (not including output shaft).
Cat. YX-2600
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Ref EA November 1985

A mozzie season special. See November EA for more info
Cat. KA-1620 **ONLY $44.50**

Books & Literature

BASIC for the IBM PC

YOUR FIRST IBM PC PROGRAM: by Rodney Zaks. Published 1984 by Sybex, Berkeley. Soft covers, 177 x 277mm, 190 pages, with appendices and glossary, profusely illustrated with cartoons and examples. ISBN 0-89588-171-3. Retail price $21.95.

This book is aimed at all those people who own an IBM PC or PC-compatible who are presently using DOS or CP/M-based programs and have yet to try programming in Basic. Zaks uses the chatty approach of his previous books to lead these people very gently into the land of Basic and supports his easy text with a wealth of cartoons.

In my opinion though, the cartoons are a little over-done and tend to distract the reader from the tasks set by the Author, which are by no means onerous. There are a lot of program examples which are very well explained.

The text is centred upon IBM Basic which is supplied on the DOS disk. IBM's extended version, Basic A, gets a mention but is not otherwise covered in the text.

However, while supposedly written just for the IBM PC Basic on disc, virtually all of the text could apply just as well to the ROM-resident Basic in the IBM PC or PC-compatibles and to virtually any personal computer which has Basic. The exceptions are those programs which employ "floating point" arithmetic.

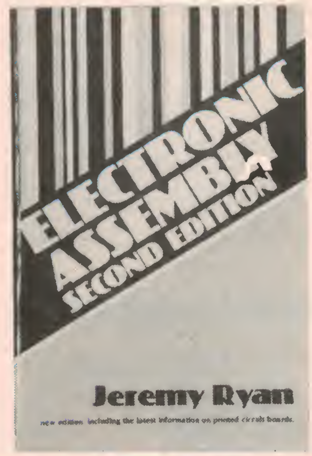
Having said that, the text can be highly recommended to any person who wants to gain a working knowledge of Basic. (L.D.S.)

Workshop Practice

ELECTRONIC ASSEMBLY: by Jeremy Ryan, published by Reston Publishing Co, Inc, 1985. Soft covers, 153 x 228mm, 185 pages, illustrated with diagrams and photographs. ISBN 0-8359-1581-6. Recommended retail price $38.95.

Offering an introduction to workshop practices, this book might prove most suitable for high school students, first year trade course students or anyone new to electronics. The opening chapter is titled "Safety" and deals with electric shock, tools and general shop rules. Other chapters include component colour coding, soldering practice and PC board manufacture.

At the end of each chapter there is a quiz or test. Generally, the questions are not too taxing and most students would have no trouble "passing". Where study is needed, explanations are presented clearly and simply. This format might prove useful for an instructor required to train completely inexperienced students — a text to be read before the first foray into the lab. Our copy was supplied by Prentice-Hall of Australia Pty Ltd. (C.R.D.).



Computer Interfacing

COMPUTER INTERFACING TECHNIQUES IN SCIENCE: by Paul E. Field and John A. Davies. Published 1985 by Scott, Foresman and Company, Glenview, Illinois. Soft cover, 193mm x 235mm, 218 pages, illustrated with diagrams. ISBN 0-673-18112-X. Retail price $US12.95.

Despite its American publisher, this book has an Australian connection. John A. Davies is a lecturer at the Queensland Institute of Technology in Brisbane. Paul E. Field is Professor of Physical Chemistry at Virginia Polytechnic Institute and State University in Blacksburg, Virginia.

The book has been written for a range of readers, from science teachers to computer hobbyists, and covers the fundamental concepts of computer interfacing. The authors believe that all you need is a basic understanding of electricity and the BASIC programming language and you're in business — measuring and controlling experiments and instrumentation with microcomputers.

What better way to learn about digital and analog electronics and the Z80 micro than by practising what is preached? To this end, each chapter includes a section of practical experiments to reinforce the theory. It soon becomes apparent that the general philosophy of the text is learning through doing.

By following it and the experiments, readers will learn how to build input and output ports, convert analog signals to digital input, and generate the control signals used for advanced interfacing. Some 30 experiments are included in the book.

A further plus is the illustrative material which is extremely comprehensive and the text is concise and easy to read. Our review copy came from the publishers: Scott, Foresman and Company, Professional Publishing Group, 1900 East Lake Avenue, Glenview, Illinois 60025, USA. (L.U.)

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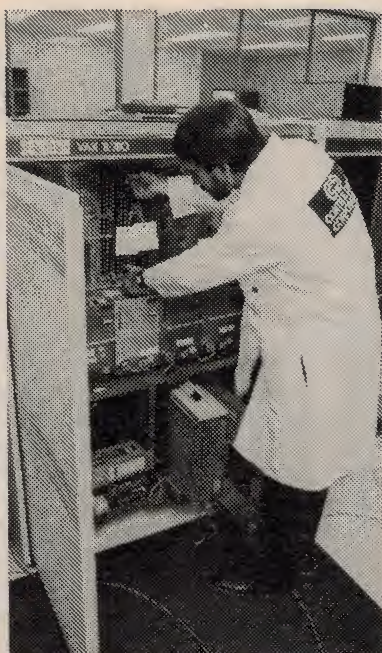

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Troubleshooting faulty projects

Not all projects work first time. In this chapter, we take a look at some simple troubleshooting procedures. We will assume that the circuit has been built exactly as described and that no parts have been substituted.

By KINGSLEY HOWE

You have completed your kit, checked it over and switched it on. It works OK? Good — enjoy the results.

But what if it doesn't work properly or not at all? Don't worry. Switch off immediately and check your work as follows.

Resistors

Begin by checking the resistors. They may be in the wrong positions. Don't use your multimeter yet — carry out a visual inspection first.

Find a place where the light is good to check the resistor values. With resistors coming from so many different manufacturers, body colours and colour brands vary a great deal. A few brands are coated with varnish for protection and this can make colours appear darker than normal.

It can also be hard to distinguish between colours. Some reds and oranges appear very similar, as do many greens and blues. It may be necessary to use a magnifying glass to distinguish the colour bands on some very small metal film resistors.

A safe method is to check the resistors with a multimeter before they are installed. The resistors cannot be measured after installation as there are now other components joined to them and this will usually give false readings.

If you must measure resistors in-circuit, unsolder one end and lift the lead clear of the board. Assuming all the resistors are in their correct places, move on to capacitors.

Capacitors

Start with the electrolytics. Are they the right way around? Are all the sides marked with arrows (negative) inserted correctly?

Have a good look. Occasionally a manufacturer marks the positive side with an arrow. Examine the 'tail' of the arrow, look for a circle in the tail. This circle contains the polarity mark (+ or −).

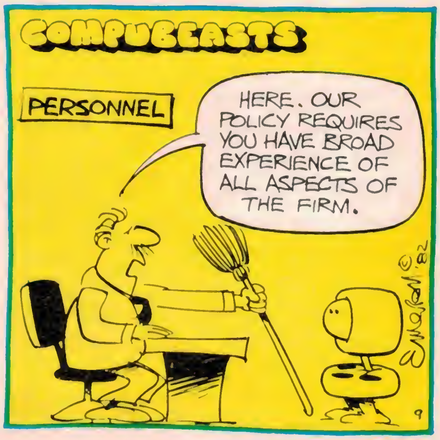
Different brands may have the polarity marked in the arrow head or inside a black stripe. Larger capacitors may be marked with a black spot on the terminal lug for negative identification. Some may be printed with the words "case is negative".

With tantalum capacitors, look for a spot marked on the body. This is the front of the capacitor and the positive lead is on the right hand side. The markings on these are industry standard for colour coded tantalums.

However, there are plain blue bodied tantalum capacitors with the value printed on the front, and a line of plus signs running down the body from top to bottom on the right hand side.

No problems here, but you may find the kit supplier has substituted blue-bodied solid aluminium resin dipped capacitors, which look exactly the same as tantalums. Some of these may have the left lead marked positive, when viewed from the front. Philips' types are marked in the conventional manner (+ leg is at the right hand side), but some Asian and American made capacitors are marked differently.

If you have installed any polarised capacitors incorrectly, and applied power to the circuit, they may be damaged. It is best to replace them. If they are destroyed internally, this is not always detectable, and you can burn out other components as well if you reuse them!



Torch Cells

What can go wrong with these? Well, they can go flat but that's not always the problem. They may also seem to be flat.

Try cleaning the cap and base with steel wool. The surface may have oxidised or oil from your fingers may have caused a high resistance contact to develop. Cleaning the ends of the cell may not put new life into it, but it will enable you to get full use from it.

In the case of partial destruction, they may still function in the circuit. However, they will then operate at a greatly reduced capacitance.

Semiconductors

Check the diodes for correct orientation. Start with the small signal diodes. These are the first to suffer should polarity be reversed.

Most of the small signal diodes are in glass cases. They may appear as normal, but could be either shorted or open circuit. Again, as with resistors, unsolder one end and lift it clear of the board.

On checking with a multimeter on the high range, one direction should read low in resistance while the other should read high. If you find a high reading in both directions or a low reading in both directions, the diode has failed.

Zener diodes, if found to be faulty, must be replaced by the exact type. Do not substitute a one watt type in place of a 400mW type — there will be a difference in impedance between the two types. The designer has probably specified the smaller size for a particular reason, and has therefore allowed a sufficient safety margin. If it is at all suspect, replace it.

Transistors

Visible damage to transistors may range all the way from a cracked case to smoke rising from the plastic body due to overheating. In extreme cases, the chip may pass so much current that it vaporizes. This causes a rapid rise in internal pressure, far more than the plastic case is capable of handling. Under these conditions, the case either develops a large bulge or explodes, leaving only three legs standing in the board.

Should any of the above occur, check all components connected to the particular transistor, otherwise the replacement could end up in the same condition.

Where no visible damage is evident,

Alan Mulraney, Stott's Graduate, in his workshop.

Troubleshooting faulty projects

after switching off, feel each transistor. Use only a light touch with the fingertip, and quickly contact each one in turn, before they have a chance to cool down.

With mains-powered equipment, switch off first, then pull the plug out of the power point (do both). **Reason:** The switch may be in the off position, but the contacts are still live. If a check shows the transistors to be cold, and all the surrounding components are correctly placed, you may have inserted the transitor leads into the wrong holes.

If you do not have test equipment and are unable to identify the base, collector or emitter leads, build yourself a tester from a kit. You can then check out which lead is which and also whether the transistor is working or not.

Remember, should you choose to take the kit to a local repairer, the cost may well exceed the price of a tester. Besides this, you will not have learned how to do it yourself, and you will have no tester for the next project.

The rule is to resort to outside help only if you are sure that you will never build another kit.

Integrated circuits

Generally, these do not show any outward signs of damage unless grossly mistreated. CMOS ICs can be ruined simply by touching the pins. These devices are sensitive to static electricity stored in the body. This may be generated by the movement of clothing or by crossing a carpet (particularly with synthetic materials).

When picking up these devices, grasp the plastic case by the ends and keep your fingers off the pins! Should the leads be hard to insert into the board, you may find that the legs are spread wider than the row of holes. You will have to bend the legs to fit.

To do this, carefully wrap the IC in aluminium foil. This shorts all the pins together, so that there is no potential difference between them. The leads may now be bent by pushing them against a flat surface (eg, a bench top). Do the same for both sides of the device so that it fits easily into the board.

One of the main reasons for an IC not working is incorrect orientation. If power has been applied, it will almost certainly have been damaged. All that can be done in this case is to take it out and replace it with a new one. Note that any components connected to it should be checked as a precaution against damaging replacement ICs as well. When installing ICs, make sure that the notch or spot denoting the pin 1 end matches the direction on the diagram or the silk screened overlay.

Switching on

Don't! With battery powered equipment, make sure the battery connections are not reversed. Measure the battery voltage first, before switching on.

After switching on, again measure the battery voltage. If there is only a small drop in voltage, well and good. A sudden fall in voltage means that the circuit is drawing a lot of current, and a fault is still present (or you have a high resistance in the switch). Poor switch contacts may not show up on the meter but, at the same time, the switch will not pass sufficient current to supply the circuit. Under these circumstances, the circuit will not function and the switch may be the only fault with it.

If the switch and battery are cleared, employ the following procedures:

Switch off. Consult the circuit diagram for voltage readings. These should be marked on the diagram at various test points near transistors and at other strategic points as selected by the designer to aid in fault finding.

Don't try to take measurements at the test points on the board by consulting the diagram and then hunting around for them. Whilst you are engaged in this, time is passing — time in which your project could cook itself out of existence. Locate the test points on the board with the power off. When you are certain of the location of each point, mark it with a felt pen and number it.

Take a scribble pad and mark down each voltage reading from the diagram against the corresponding number. Now switch on and compare your readings with the list you have made. This will help you check quickly. Any differences will enable you to pin down the fault to a particular section. After that, it is up to you.

With mains-powered projects, make sure all connections at mains potential are covered with insulation tape. You will be placing your hands near them — play it safe!

Before switching on, check the connections to the mains transformer — you may have it in back to front! If this is OK, check the secondary AC voltage first, then check the DC rail voltage. Both should be close to that marked on the diagram.

Colour blindness

If you have a tendency to install resistors in the wrong positions, you may be colour blind.

To check this, buy a pack of mixed resistors (200-300) and sort them according to value.

Now check the values on your multimeter. If more than 10 are incorrect, get your colour vision tested. If you are colour blind, this would present problems in industry or service work.

Plugpacks can cause problems

Be careful when powering battery-operated equipment from plugpack transformers. These invariably suffer from poor regulation and their output voltage may be much higher than that specified.

For example, on a 6V plugpack, the open circuit voltage measured nearly 10V. When using this to power a radio-cassette recorder, the output voltage fell to around 7.5V under load. This rose to somewhere near the open-circuit level whenever the volume was turned down or when tuning between stations.

This generally has no ill effect on equipment with silicon transistors. However, some cassette players, radios and intercoms, particularly those of Asian manufacturers, still use germanium transistors which are prone to failure under these conditions.

One solution is to fit 1A diodes in series with the supply to drop the voltage to a safe level. These can usually be fitted inside the case of the relevant item.

Another solution is to use a plugpack regulator. A suitable circuit was described in *Electronics Australia* in January 1983 (File No. 2/PS/53).

WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR C

WHEN GEOFF DOES A KIT HE DOES IT PROPERLY

Geoff's policy is to do a few kits and do them well. Rather than bundle up bits and pieces for everything under the sun, Geoff takes a lot of trouble to get all the RIGHT parts for just a few projects. As a result you can be assured that there are no dubious substitutions and that all parts are prime spec.

Also the projects are checked out before the kit is even considered. Both of this month's projects had mistakes in the original articles – in both cases the PCB layout was incorrect – and Geoff was the one who spotted the errors.

AEM4600 DUAL SPEED MODEM

Geoff can't put this kit together fast enough. The queue started to form the moment the magazine came out.

Features both 300/300 baud full duplex and 1200/75 baud half duplex operation so it's ideal for Viatel. All functions are selected with quality C&K toggle switches with four LEDs to indicate correct functioning. Interfacing is standard RS232 using a minimum of signal lines for "universal" interfacing.

Geoff's kit comes complete with punched front panel (looks like a bought one!) and is just **$159.00**

ETI 169 LOW DISTORTION OSCILLATOR

If you're checking out Hi Fi systems then an audio oscillator is a must. The trouble is that the average el-cheapo probably has a higher level of distortion than a $10 transistor radio. So with this kit there can be NO compromises. The distortion just has to be better than 0.001%. Covers the frequency range to 100kHz. Geoff has checked the whole thing through with Ian Thomas (including pointing out the track error on the pcb).

Kit again includes a posh front panel and the top quality AB pot (available separately at **$9.00**).

Complete kit **$179.00**

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If you're finding it hard to get the wafer switch you want for a particular project give Geoff a call. He can build to your order from the high quality Lorlin RA range – and up to 6 banks. The following configurations are available:

Poles	1	2	3	3	6	4	2
Positions	12	6	3	5	2	4	9

Contacts have a 5A rating with only 10 milliohm resistance. Diameter is 25.4mm.

DC Voltage	
Range	• 200mV, 2V, 20V, 200V, 1000V
Resolution	• 10uV, 100uV, 1mV, 10mV, 100mV
Accuracy	• 200mV 1000V ± (0.05%rdg + 3dgt)
AC Voltage (True RMS, AC coupled 10% to 100% of range)	
Range	• 200mV, 2V, 20V, 200V, 750V
Resolution	• 10uV, 100uV, 1mV, 10mV, 100mV
Accuracy	• 200mV – 200V @45Hz 1KHz ± (0.5%rdg + 20dgt) @1KHz 2KHz ± (1.2%rdg + 30dgt) @2KHz 5KHz ± (5.0%rdg + 40dgt) (200V @2KHz 5KHz not specified) 750V @45Hz 1KHz ± (1.0%rdg + 20dgt)
DC Current	
Range	• 2mA, 20mA, 200mA, 2A, 10A
Resolution	• 100nA, 1uA, 10uA, 100uA, 1mA
Accuracy	• 2mA 200mA ± (0.3%rdg + 3dgt) 2A 10A ± (0.75%rdg + 3dgt)
AC Current (True RMS, AC coupled 10% to 100% of range)	
Range	• 2mA, 20mA, 200mA, 2A, 10A
Resolution	• 100nA, 1uA, 10uA, 100uA, 1mA
Accuracy	• 2mA @45Hz 400Hz ± (2.5%rdg + 20dgt) 20mA 200mA @45Hz 400Hz ± (0.75%rdg + 20dgt) @400Hz 1KHz ± (0.75%rdg + 30dgt) 2A 10A @45Hz 500Hz ± (1.2%rdg + 20dgt)
Resistance	
Range	• 200Ω, 2KΩ, 20KΩ, 200KΩ, 2MΩ, 20MΩ
Resolution	• 0.01Ω, 0.1Ω, 1Ω, 10Ω, 100Ω; 1KΩ
Accuracy	• 200Ω ± (0.2%rdg + 5dgt + 0.04Ω) 2KΩ 200KΩ ± (0.1%rdg + 3dgt) 2MΩ ± (0.15%rdg + 3dgt) 20MΩ ± (0.5%rdg + 3dgt)

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New Products...
Product reviews, releases & services

Video depth sounder

Imark Pty Ltd have released the Imark DM-60 Video Sounder, for use by sport fishermen or pleasure boaters.

The DM-60 has a maximum range of 146 metres and utilises a 15 cm (diagonal) CRT screen instead of the usual chart paper to display the sea bottom, reefs and fish beneath the vessel.

There are six basic depth ranges: 0-10, 0-20, 0-40, 0-80 and 0-160 metres. A "Freeze Frame" facility as well as a normal dynamic display is included and the control panel is backlit for night use.

The sounder has membrane switches to select the sweep speed, to impose an electronic graticule screen over the CRT display, for selection of deep and shallow alarms and there are rotary controls for Gain, Alarm Loudness, Screen Brightness and Power On/Off.

Further details can be obtained from the importers, Imark Pty Ltd, 167 Roden Street, West Melbourne, Victoria 3003. Telephone: (03) 329-5433.

Loudspeakers with extended bass response

Designed and manufactured in Australia by Audiosound Laboratories, the new 8035 loudspeakers offer sub-woofer bass performance by using a newly developed 200mm bass driver unit with a high temperature voice coil wound on an aluminium former. Their power handling capacity is adequate for use with amplifiers up to 50 watts RMS.

The enclosure is designed to Thiele principles and the low frequency alignment is −3dB around 38Hz and only −5dB around 30Hz. Dimensions of the 8035s are 1040mm (H) x 310 (W) x 390 (D).

For further information contact Audiosound Laboratories, 148 Pitt Road, North Curl Curl 2099. Telephone: (02) 938 2068.

Inbuilt VCR alarm system

DCB Computer Marketing has developed an alarm system for VCRs and other electrical home appliances which operates via the 240V AC electric supply.

The system consists of an FM transmitter and receiver which operates via the AC mains, as with wireless intercoms. The receiver is built into the VCR and a continuous coded signal is fed from the transmitter via the building's electrical wiring. In the event of the VCR being unplugged, the receiver emits an ear-piercing audio alarm and also prevents the VCR from working from any mains outlet in another building.

For proper operation both the transmitter and receiver/s should be operating on the same electrical phase.

For further information contact DCB Computer Marketing, 81 Kingsclere Avenue, Keysborough, Victoria, 3173. Telephone: (03) 798 2323.

Cassette tutorials for program learning

This new learning system is ideal for first-time users wanting to quickly learn programs from a wide range of available microcomputer products.

With the emphasis on doing, rather than reading, the user is guided step by step through the programs with the aid of instructions on audio cassettes.

The total package for a particular program comprises the disks for the specified computer, a fully indexed lesson summary and the audio cassettes. Any standard cassette player may be used, with no computer hook-up required.

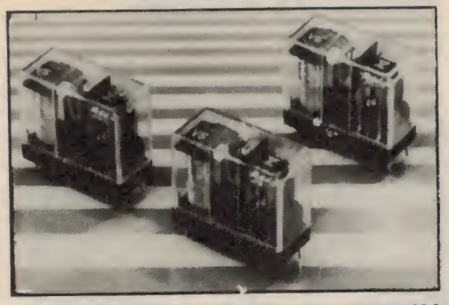
Packages available include Lotus

1-2-3, MS-DOS, Wordstar, Mailmerge, Multiplan and an Introduction to BASIC.

For example, the MS-DOS tutorial teaches the user to master the keyboard and essential DOS commands and the procedures for disk storage and file management with floppy disks and, as an option, a fixed or hard disk drive. Use of a printer and special features of DOS, such as tree-structured directories and batch processing, are also covered.

For further information contact Barrington Corporation, PO Box 683, Norwood 5067. Telephone: (03) 332 0122.

New relays have high voltage isolation



An addition to the Fujitsu FBR600 series of miniature PCB-mounting types of relays has been released by IRH Components.

The model features 16-amp contact rating (240V AC or 30V DC resistive) in SPST format. Single coil magnetic latch types are also available in SPST and DPDT format.

The FBR600 series has 5kV RMS or 10kV impulse contact to coil isolation and has SECV approval. The available coil voltage range is from five to 60V with 5, 6, 12, 24 and 48V being the preferred types.

For further information, contact IRH Components, 32 Parramatta Road, Lidcombe 2141. Telephone: (02) 648 5455.

J. J. Float headphones now available

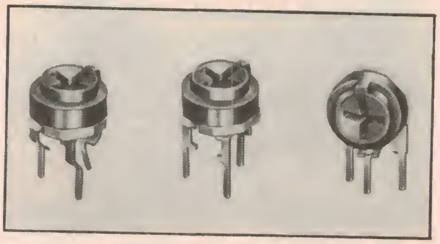
Audio Dynamics have just released the range of J. J. Float headphones in Australia. Three models are available, including the Model I and Model II, which are both two-way dynamic types priced at about $169 and $199 respectively. The top model J. J. Float is electrostatic and comes with its own power supply unit which will drive two sets of phones. The power supply and one headset is priced at $749.

They look a little heavy and unwieldy but are quite light to wear. The manufacturers claim that the design has been produced as a way of preventing distortion of the pinna (the outer ear) which is both uncomfortable and causes auditory passage distortion and unnatural brightness of sound.

More information is available from the Australian distributor Audio Dynamics, 155 Camberwell Road, East Hawthorn 3122.

New Products...

Miniature cermet trimmer



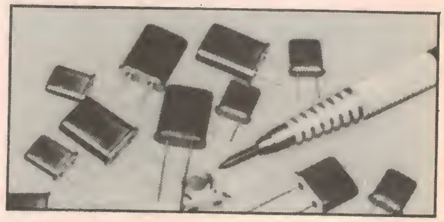
IRH Components have introduced the new Murata miniature RVG070H horizontal adjust cermet trimmer.

While only 6mm in diameter, it provides a relatively high power dissipation of 300 milliwatts. Available resistance range is 100Ω to 1mΩ, with a tolerance of ±20%.

The device is made of cermet resistive film printed on an alumina substrate. Because of its dust-proof and multi-contact wiper structure, the RVG070H series offers good contact stability. Residual resistance is five ohms or 1% of nominal value.

For further information, contact IRH Components, 32 Parramatta Road, Lidcombe 2141. Telephone: (02) 648 5455.

Motorola MFX crystal filters



The MFX series is an extensive line of monolithic crystal filters supplied by Motorola. They offer 4-pole narrow bandwidth performance, from 45MHz to 175MHz, in a single TO-8 package.

Motorola claim that the frequency selectivity provided directly at these frequencies would be ideal for those communication's applications which require small size and simplified circuit schematics.

The MFX series is available in a straight 4-pole pole filter configuration, two separated 2-pole filter configuration, or a custom circuitry module tested and adjusted by Motorola.

For further information contact the Sydney sales office on (02) 438-1955.

CAD program for PCB design

The Protel-PCB is an Australian-developed low cost, multi-layer, printed circuit board design program. Protel-PCB software offers facilities for the creation of camera-ready PCB artwork.

Specifications include the option of up to 6 track layers, plus two additional layers for component overlay and text. Provision has been made for an adjustable grid size from 0.01 to 0.1 inch.

The plotter output provides either a 1:1 multicolour fast check plot, or a 2:1 final artwork plot.

For further information contact HST Industries Pty Ltd, 445 Macquarie Street, Hobart, Tasmania 7000. Telephone: (002) 34 8499.

Imagination gets carried away.

You know how exciting the pure, perfect sound of Compact Disc can be.

Well now Philips, creators of Compact Disc technology, have created the pure, perfect and powerful sound of the CD 555.

It's the big portable Compact Disc deck with a more powerful sound to carry around. Pure and perfect, wherever you find yourself.

Of course this sound machine also features an auto reverse cassette deck, four band tuner, 2 x 25 watt amplifier and two way speakers.

But when you have this much imagination it's hard not to get carried away.

Philips Compact Disc.
Imagination leads the way.

We want you to have the best.

PHILIPS

PMP 1564

Electronics Australia Binder &

WIRELESS WEEKLY. Our own time machine! It may look like a book, but don't let it's appearance fool you. There are no whirling dials and control levers; but once you open the cover, it'll take you on an incredible journey backwards in time. You'll find yourself back in the 1920's, when Australia's first few radio stations were just getting established and a typical radio set cost ten weeks' wages. We've chosen a collection of highlights from the 1927 issues of 'Wireless Weekly': You'll find some front covers, a few editorials, the best new items, a collection of typical do-it-yourself radio set designs, and some selected pages from the programme listing. Plus a sprinkling of the original advertisements, of course. These are particularly fascinating because they show prices and put everything into proper context. Send today for ***The Best of Australia's Wireless Weekly in 1927*** . . . A fascinating and nostalgic trip into our radio past. **N0049A** **$3.95**

ELECTRONIC PROJECTS FOR YOUR CAR. How can you extend the performance of your car without it costing an arm and a leg? With these selected projects from *Electronics Australia* you can add all of the gadgets you've dreamed of: Cruise Control, Courtesy Light Delay, Deluxe Burglar Alarm, Headlight Reminder, Audible Reversing Alarm, Transistor-assisted Ignition with Optoelectronic Trigger, Driveway Sentry, Speed Sentry, Tacho/Dwell Meter, Breakerless Ignition, Audible Turn Signal and more easy-to-build projects to add value, interest and safety to your pride and joy! PLUS Feedback from those who have built the projects themselves and Bright Ideas for you to develop yourself: Automatic Antennae Retraction, 6V Car Adaptor, Fuse-Failure Indicator and more . . . **C0064A** **$3.95**

ELECTRONIC TEST GEAR TO BUILD. Why buy it? These valuable projects from *Electronics Australia* will add a new dimension to your workshop! Detailed, step-by-step instructions guide you through the construction of the most useful of electronic workshop test gear: 500 MHz 7-digit Frequency Meter, Wheatstone Bridge and Resistance Box, AC Millivoltmeter, DC Voltmeter, LCR Bridge, Modulated Signal Injector, Audio Prescaler. PLUS Feedback from those who have built the projects themselves and Bright Ideas for you to develop yourself: Linear Frequency Controller, Dummy Loads, General Purpose Counter Timer and more . . . **Never built a project before?** What better way to get started than by building the test instruments needed to begin a workshop? **Build it yourself to save and learn at the same time!** **F0067A** **$3.95**

EASY-TO-UNDERSTAND GUIDE TO HOME COMPUTERS. Confused by all these computer terms? This clearly written book from the editors of *Consumer Guide* tells exactly what computers are, how they work and why they are so amazingly useful, all in plain English. Here is all of the information needed to understand and use computers, and even to start programming. A special buying section compares the most popular home computers. This book is your ticket to the computer age! Spiral bound, 96pp. **H0066G** **$8.50**

THE USER'S GUIDE TO COMMODORE 64 & VIC 20. The editors of *Consumer Guide* have compiled a thorough introduction to the Commodore 64 and Vic 20 computers, software and peripherals. With colour illustrations and a clearly written text, this reference will guide the newcomer through all phases of learning how to use the computer: From setting the system up, expanding the system with peripherals, to buying new software. Specific exercises are included for each of the keys. Spiral bound, 80pp. **H0065G** **$8.50**

MAGAZINE BINDERS B901EA

Ready to use binders with easy, clip-in fastener, covered in soft, decorator brown vinyl. Holds 12 issues of electronics Australia.

$7.50

Postage and packing additional.

MAGAZINE HOLDERS H951EA

Big, easy to assemble holders, covered in soft, decorator brown vinyl. Holds 12 issues (at least) of Electronics Australia.

$7.00

SAVE WITH SIX

6 Holders — only **$37.50**
6 Binders — only **$39.95**

SERIES 5000

INDIVIDUAL COMPONENTS TO MAKE UP A SUPERB HIFI SYSTEM!

By directly importing and a more technically orienta...
organisation, ROD IRV...

WHILE OUR CURRENCY IS DEVALUING PRICES WILL RISE, SO BE QUICK!

... we also ... assembled and tested.

POWER AMPLIFIER

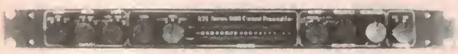
WHY YOU SHOULD BUY A "ROD IRVING ELECTRONICS" SERIES 5000 POWER AMPLIFIER....

- 1% Metal Film resistors are used where possible.
- Alumimium case as per the original article.
- All components are top quality.
- Over 1000 of these kits now sold.
- Super Finish front panel supplied at no extra cost.

Please note that the "Superb Quality" Heatsink for the Power Amplifier was designed and developed by ROD IRVING ELECTRONICS and is being supplied to other kit suppliers.

SPECIFICATIONS: 150 W RMS into 4 ohms
POWER AMPLIFIER: 100W RMS into 8 ohms (+ -55V Supply)
FREQUENCY RESPONSE: 8Hz to 20Hz +0 = 0.4 dB 2.8Hz to 65KHz, +0=3 dB. NOTE: These figures are determined solely by passive filters.
INPUT SENSITIVITY: 1 V RMS for 100W ouput.
HUM: 100 dB below full output (flat)
NOISE: 116 dB below full output (flat, 20KHz bandwidth)
2nd HARMONIC DISTORTION: <0.001% at 1 KHz (0.0007% on Prototypes) at 100W ouput using a + = 56V SUPPLY rated at 4A continues <0.0003% for all frequencies less than 10KHz and all powers below clipping
TOTAL HARMONIC DISTORTION: Determined by 2nd Harmonic Distortion (see above)
INTERMODULATION DISTORTION: 0.003% at 100W. (50Hz and 7KHz mixed 4:1)
STABILITY: Unconditional

Cat. K44771 **Will be $359, limited stock available at $339**
Assembled and tested $549
packing and post $10



PREAMPLIFIER

THE ADVANTAGES OF BUYING A "ROD IRVING ELECTRONICS" SERIES 5000 PREAMPLIFIER KIT ARE....

- 1% Metal Film Resistors are supplied.
- 14 Metres of Low Capacitance Shielded Cable are supplied (a bit extra in case of mistakes).
- English "Lorlin" switches ae supplied (no substitutes here.)
- Specially imported black anodised aluminium knobs.

Available Assembled and Tested. (We believe that dollar for dollar there is not a commercial unit available that sounds as good!)

SPECIFICATIONS:
FREQUENCY RESPONSE: High-level input: 15Hz - 130KHz, +0 - 1dB Low-Level input-conforms to RIAA equalisation + - 0.2dB
DISTORTION: 1KHz <0.003% on all inputs (limit of resolution on measuring equipment due to noise limitation).
S/N NOISE: High-Level input, master full, with respect to 300mV input signal at full output (1.2V)>92dB flat >100dB A-weighted, MM input, master full, with respect to full output (1.2V) at 5 mV input 50ohms source resistance connected, >86dB flat/92dB A-weighted MC input, master full, with respect to full output (1.2V) and 200uV input signal. >71dB flat >75dB A-weighted

Cat. K44791 **Will be $319, limited stock availble at $299**
Assembled and tested $599
packing and postage $10

THIRD OCTAVE GRAPHIC EQUALIZER

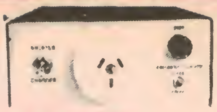
SPECIFICATIONS:
BANDS: 28 Bands from 31.5Hz to 16KHz.
NOISE: <0.008mV, sliders at 0, gain at 0(=103dB0).
20KHz BANDWIDTH DISTORTION: 0.007% at 300mV signal, sliders at 0, gain at 0, maximum 0.01%, sliders at minimum.
FREQUENCY RESPONSE: 12Hz = 105KHz, +0, = 1dB, all controls flat.
BOOST AND CUT: 14dB

Cat. K44590 1 unit: **will be $219, limited stock availble at $199**
2 unit: **will be $429, limited stock available at $194**
packing and postage $10

SERIES 4000 SPEAKERS

8 Speakers On $295
8 Speakers with Crossovers **$499**
Speaker Boxes (assembled with grill and speaker cutout) $325
Crossover Kits $199
Complete kit of parts (speakers, crossovers, screws, innerband boxes.) $799
Assembled, tested and ready to hook up to your system $895

Errors and Ommissions Excepted



40 W INVERTER

This 12/240 V inverter can be used to power up mains appliances rated up to 40 W, or to vary the speed of a turntable. As a bonus, it will also work backwards as a trickle charger to top up the battery when the power is on. (EA May'82) 82IV5
Cat. K82050 **$57.50**

GENERAL PURPOSE PREAMPLIFIER

A general purpose stereo preamplifier using a single LM382 IC which can be tailored for use with magnetic pickups, tape recorders or microphones by changing a few components. (ETI445) (ETI July '76)
Cat. K44490 **$8.95**

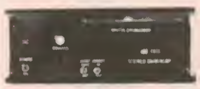
ON SPECIAL! SAVE $7.45

ELECTRONIC MOUSETRAP

This clever electronic mousetrap disposes of mice instantly and mercifully, without fail, and resets itself automatically. They'll never get away with the cheese again! (ETI Aug.'84) ETI 1524
Cat. K55240 **$27.50**

VOICE OPPERATED RELAY

EA's great Voice Operated Relay can be used to control a tape recorder, as a VOX circuit for a transmitter or to control a slide projector. (EA Apr '82) 82VX4
Cat. K82043 **$17.95**



STEREO ENHANCER

The best thing about stereo is that it sounds good! The greatest stereo hi-fi system loses its magnificence if the effect is so narrow you can't hear it. This project lets you check on being cheated and creates an 'enhanced stereo effect' with a small unit which attaches to your amp. (ETI 1405, ETI, MAR '85)
Cat. K54050 **$79.50**

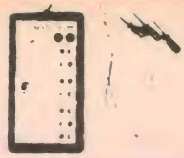
MULTI SECTOR ALARM STATION

The Christmas season always brings with it an increase in home burglaries, so nows the time for installing security equipment. Relieve the boredom, save money, and at the same time protect your home from intruders with this up-to-the-minute burgular alarm system. Its easy to build, costs less than equivalent commercial units, and features eight seperate inputs, individual sector control, battery back up and self-test facility

Specifications:

- Eight sectors with LED status indication.
- Two delayed entry sectors
- Variable exit, entry and alarm time settings: entry delay variable between 10 and 75 seconds; exit delay variable between 5 and 45 seconds, alarm time variable between 1 and 15 minutes
- Resistive loop sensing: suits both normally open and normally closed alarm sensors.
- Battery back-up with in-built charger circuit.
- Built-in siren driver.

Complete kit including deluxe prepunched metal work and electronics for only...
Cat. K85900 **$129**



TRANSISTOR TESTER

1000's SOLD

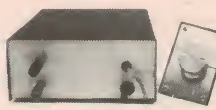
Have you ever desoldered a suspect transistor, only to find that it checks OK? Trouble-shooting exercises are often hindered by this type of false alarm, but many of them could be avoided with an "in-circuit" component tester, such as the EA Handy Tester. (EA Sept.'83) 83TT8
Cat. K83080 **$17.95**

300 BAUD DIRECT CONNECT MODEM

Modem? What do I want with a modem? Think of these advantages:

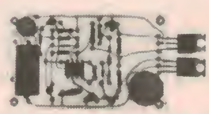
- Can't afford a floppy disc? Use your telephone to access one for the cost of a call.
- Bored with your old programs? Download hundreds of free programs.
- Want to get in touch with fellow computer enthusiasts? Use 'electronic mail'.
- Ever used a CP/M system? CP-DOS? UNIX? Well a modem will make a your computer a remote terminal on some of the most exciting systems around.

Save on ready built modems.
Cat. K97050 **$119**
(Short form without phone)



LOW-COST BIPOLAR MODEL TRAIN CONTROLLER

Here is a simple model train control for those enthusiasts who desire something better than the usual rheostat control. It provides much improved low speed performance and is fully overload protected, yet contains relatively few componenets. Best of all, you don't need to be an electronic genius to construct it. (80TC12) (EA Dec '80)
Cat. K80120 **$39.95**



GENERAL PURPOSE AMPLIFIER CLASS B

One of the handiest 'tools' for the electronics experimenter is a genuine purpose audio amp. This module will work from a wide range of supply voltages, has good sensitivity, is robust and reliable - easy to build too! (ETI 453) (ETI April '80)
Cat. K44530 **$24.50**

150W MOSFET POWER AMPLIFIER

Here's a high power, general purpose 150W Mosfet Power Amp Module! Suitable for guitar and P.A. applications and employing rugged, reliable Mosfets in the output stage. (ETI 499) (ETI March '82)
Cat. K44990 **$79**
(Heatsink not included)
plus transformer **$49.50**

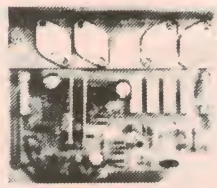
BACK IN STOCK!

300W "BRUTE" AMPLIFIER

The "Brute" develops 300W into 4 ohms, 200W into 8 ohms!
For many aduio applications there's no substitue for sheer power - low efficiency speakers, outdoor sound systems, or maybe you like the full flavour of the dynamic range afforded by a high power amp. Whatever your requirement - this 'super power' module should fill the bill. (ETI 466) (ETI Feb '80)
Cat. K44660 **$89.95**
(Heatsink not included)

ZENER TESTER

A simple low cost add-on for your multimeter. This checks zeners and reads out the zener voltage directly on your multimeter. It can also check LEDs and ordinary diodes. (ETI May'83) ETI 164
Cat. K41640 **$9.95**



MOSFET POWER AMPLIFIER

Employing Hitachi Mosfets, this power amplifier features a 'no compromise' design, and is rated to deliver 150 W RMS maximum and features extremely low harmonic, transient and intermodulation distortion.
ETI 477 (ETI Jan.'81)
(Single module only)
Cat. K44770 **$79.50**
Plus power supply (No trans) **$49**
Plus transformer PF4361/1 **$49.50**

BACK IN STOCK!

PARALLEL PRINTER SWITCH

Tired of plug swapping when ever you want to change from one printer to another? This low-cost project should suit you down to the ground. It lets you have two Centronics-type printers connected up permanently, so that you can select one or the other at the flick of a switch. (ETI 666, Feb. '85)
Cat. K46660 **$79.95**

50 W AMPLIFIER MODULE (ETI 480)

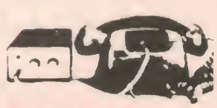
Cat. K44880 **$27.50**
(Heatsink optional extra)

100 W AMPLIFIER MODULE (ETI 480)

Cat. K44801 **$29.95**
(Heatsink optional extra)

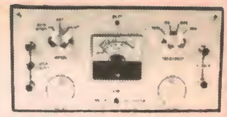
EPROM PROGRAMMER

If you have ever wanted to rewrite or extend the operating system of your microcomputer or if your're interested in dedicated microprocessor applications then this EPROM Programmer is just the thing. It is an inexpensive unit that uses readily available IC's, interfaces directly to the expansion bus on the back of all the popular 8080/Z80 microcopmputers and programs 2708's, 2716's, 2758's and 2732's. (EA July '80) 80PP71
Cat. **$79.50**
(Horwood case supplied)



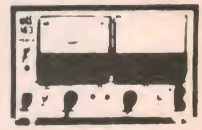
PHONE MINDER

Dubbed the Phone Minder, this handy gadget functions as both a bell extender and paging unit, or it can perform either function separately. (EA Feb '84) 84TP2
Cat. K84021 **$27.50**



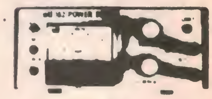
AUDIO TEST UNIT

Just about everyone these days who has a stereo system also has a good cassette deck, but not many people are able to get the best performance from it. Our Audio Test Unit allows you to set your cassette recorder's bias for optimum frequency response for a given tape or alternatively, it allows you to find out which tape is best for your recorder. (81AO10) (EA Oct '81)
Cat. K81101 **$59.95**



LAB SUPPLY

Fully variable 0-40V current limited 0-5A supply with both voltage and current metering (two ranges: 0-0.5A/0-5A). This employs a conventional series-pass regulator, not a switchmode type with its attendant problems, but dissipation is reduced by unique relay switching system switching between laps on the transformer secondary. (ETI May'83) ETI 163
Cat. K41630 **$182.50**



30 V/1 A FULLY PROTECTED POWER SUPPLY

The last power supply we did was the phenomenally popular ETI-131. This low cost supply features full protection, output variation from 0V to 30V and selectable current limit. Both volatage and current metering is provided. (ETI Dec '83) ETI 162
Cat. K41620 **$52.50**

ELECTRONIC WATT METER

This unit will measure the power consumption of any mains appliance with a rating up to 3 kilowatts. It makes use of a special op amp called an 'output transcon-ductance amp' or OTA, for short. (EA Sept '83) 83WM8
Cat. K83082 **$89.95**

rie

ROD IRVING ELECTRONICS
425 High Street, NORTHCOTE, 3070
VICTORIA, AUSTRALIA
Phone (03) 489 8866
48 A Beckett St, MELBOURNE, 3000
VICTORIA, AUSTRALIA
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$500 plus	$12.50

This is for basic postage only. Comet Road freight, bulky and fragile items will be charged at different rates.
Certified Post for orders over $100 included "free"!
Registered Post for orders over $200 included "free"!
All sales tax exempt orders and wholesale inquiries to RITRONICS WHOLESALE, 56 Renver Rd, Clayton. Phone (03) 543 2166

MasterCard VISA

Errors and Omissions Excepted

New Products

New echo sounder from Imark

This compact echo sounder features two ranges: 0-20 metres and 0-60 fathoms (360ft). Designated the SMR SX-6000A, it features two built-in alarms (deep and shallow) which can be set at any depth. This "Bottom Trak" feature can be used as an anchor watch when anchored at night.

The SX-6000A also features a rugged ABS housing designed to withstand the marine environment. This housing incorporates a built-in sun shade and a glare proof dial to ensure good visibility. Dimensions are 190 x 140 x 100mm (W x H x D). The unit is supplied complete with a power cable, transducer and operator's manual.

For further details contact Imark Pty Ltd, 167 Roden St, Melbourne 3003. Telephone (03) 329-5433.

New data-powered optical fibre modem

A data-powered optical fibre modem which requires no separate power connection has been designed and manufactured in Australia by Amalgamated Wireless (Australasia) Limited (AWA).

The FIE8 Optical Fibre RS232 modem is totally powered by receive and transmit data signals. The user can plug the modem into the back of an RS232 outlet or computer peripheral and connect the fibre cable for the system to be fully operational.

Transmitting asynchronous data at a rate of 19,200 bits per second over distances of up to 2km, the FIE8 optical fibres are non-conductive and thus eliminate electromagnetic and radio frequency interference.

For further information contact AWA on (02) 887-7111.

Brushless motor commutator IC

National Semiconductor Corporation recently introduced the LM621 which controls the power switching devices used to drive a brushless DC motor.

This commutator IC provides an adjustable dead-time circuit to eliminate "punch-through" current spiking in the power switching circuitry. Operation is from a 5-40V supply. Logic inputs are TTL compatible.

The LM621 is compatible with three and four-phase, delta or Y-wound, motors. Applications for the IC include robotics, brushless DC fans and speed servos.

Pulsar Electronics has 16-Bit CPU card

Pulsar Electronics has designed a CPU card for the multi-user environment which is capable of running TurboDos, CP/M 86 and MS-DOS operating systems.

The Pulsar 6016 CPU card was designed using Mil-spec multiwire circuitry and has the 80186 processor running at 8MHz. It is available with either 256K or one Megabyte of DRAM on board.

For further information, contact Pulsar Electronics, Lot 67 Catalina Drive, Tullamarine, Victoria 3043. Telephone: (03) 429 2977.

New Products...

Oscilloscopes for rack mounting

Standard 19-in rack-mounting versions of three general purpose Philips oscilloscopes have been made available. The PM 3215R single and PM 3217R dual-time base 50MHz models and the PM 3267R 100MHz unit can be integrated into standard racks for a wide range of applications.

The PM 3215R and PM 3217R models feature 50MHz bandwidths with 2mV sensitivities for their dual vertical inputs. The PM 3267R includes a third trigger-view channel, alternative display of main and delayed timebases and comprehensive trigger facilities.

For further information contact Philips Scientific and Industrial, 25-27 Paul Street, North Ryde 2133. Telephone: (02) 888-8222.

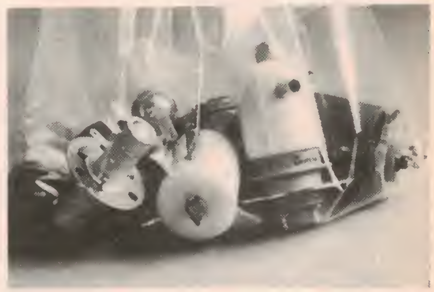
Multitasking BASIC tool

The Pro-Log Corporation has released a multitasking, Z80-based software module for the STD Bus. Multi-Basic allows an engineer to create and execute, in real-time, a BASIC program that can control up to 16 tasks simultaneously. The product would work well with automated industrial control applications that involve multiple operations.

At its core is a multitasking BASIC interpreter located in ROM on Pro-Log's 7806 CPU board. This interpreter handles standard BASIC commands and several enhance commands, which make sure the timing and I/O port values are correct before executing a task.

For further information contact Pro-Log Pty Ltd, PO Box 1, Canterbury, Victoria, 3126. Telephone: (03) 836 3533.

Vacuum relays upgraded



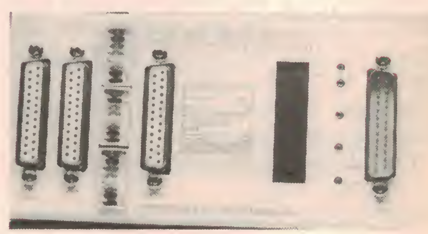
Using a silicon coating, the dielectric strength of Siemens series 300 vacuum relays has been increased from 4.5 to 8.0kV and series 400 from 12 to 14kV.

Vacuum relays are the ideal choice for use in antenna matching applications. When changing channels, the output power of a radio transmitter operating between 0 and 40MHz can be fed into the antenna via different matching circuits to obtain optimum results. The RF power is directly switched by the vacuum relay.

These relays have also found widespread application in measuring instruments. The defined vacuum inside these switching elements makes their performance independent of outside pressure conditions.

Contact Siemens Ltd, 544 Church St, Richmond, Victoria 3121. Telephone: (02) 436-8730.

RS232 data line test equipment



Aspect Engineering has a range of three RS-232 and V.24 test devices now available for the Australian market. They are intended to provide practical, low cost test and monitoring of data communication equipment.

The first in the range is the Fakerscope which features a combination of keypad controlled menus and switches to access or capture data, or generate test messages.

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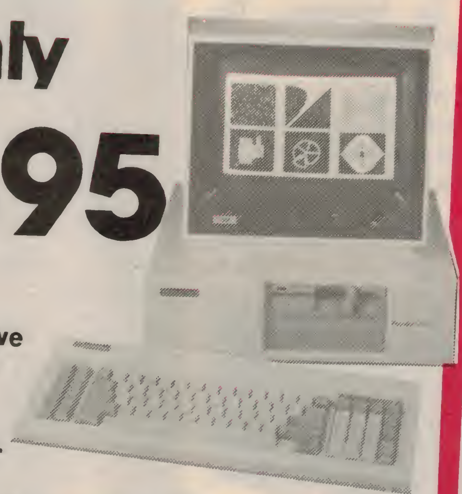

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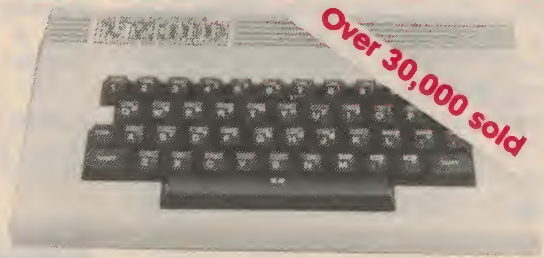

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For Address details See P98

The second instrument is the Datafaker which allows testing of line faults to identify terminal problems. In addition to breakout and patching facilities, multi-function message generator and error checker operations are provided.

The third instrument is the Cablefaker. This is a Break-Out Box with a liquid crystal display of 16 of the more commonly used line signals. Additional patching for negative and positive signals is provided, and a pulse-catch monitor is included.

For further information, contact Aspect Engineering, Unit 4, 27 Lexton Road, Box Hill 3149. Telephone: (03) 890 5415.

Clip-on ammeter for arc welding

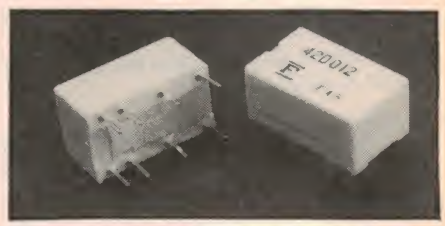
This diagnostic tool from Warsash is for use by engineers and designers involved in setting up or designing welding equipment or electroplating equipment where average current and surge current values are important. The HEME 1000A registers these on a digital display with a hold memory for surge and normal readings.

An analog output socket permits current readings to be recorded on a chart recorder and simultaneously displayed on a CRO.

The HEME 1000A is autoranging from 0-1000 amps, from DC to 1kHz in two ranges 0-200A and 0-1000A. It is supplied with two way analog output lead, leather carry case and 9V alkaline battery.

For further details contact: Warsash Pty Ltd, PO Box 217, Double Bay, NSW 2028. Telephone: (02) 30-6815.

DPDT miniature relay with low power coil



The new Fujitsu FBR40 series of micro-miniature PCB relays has been released by IRH Components. Measuring 16x10x8mm, the FBR40 has dual-in-line terminal pitch and features permanent magnetic-assisted armature operation. This results in a coil power dissipation of only 200 milliwatts. A range of coil voltages from three to 24V DC is available.

The double-pole double-throw bifur-

cated contacts are rated at one amp at 24V DC for resistive loads and are suitable for low level applications. All the terminals are sealed for automatic soldering and two terminals are preformed to lock the relay onto a PCB and prevent movement during soldering.

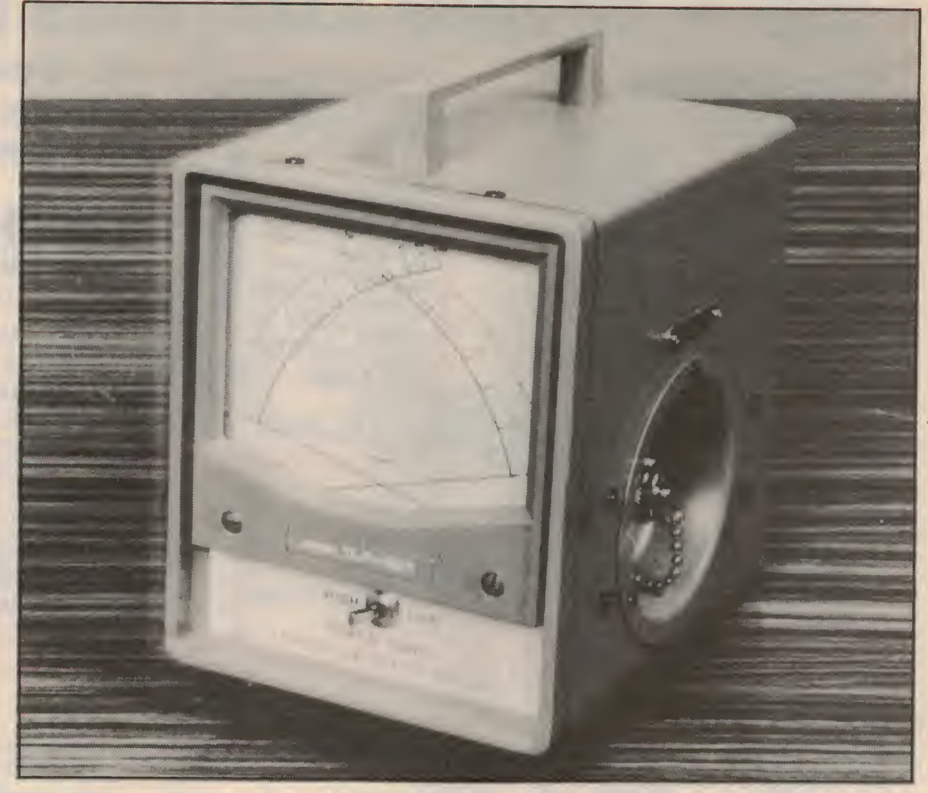
For further details contact IRH Components, 32 Parramatta Road, Lidcombe 2141. Telephone: (02) 648-5455.

New through-line power meter

Vicom has a new range of RF Thru-Line Powermeters from the Fujisoku Electric Company.

The new series TLP-52X is capable of directly reading forward and reflected power via two separate meter movements in the one common housing. In addition, it is possible to read the standing wave ratio (SWR) at the point where the two meter pointers cross.

Frequency coverage is 1.8 to 1000MHz with two forward power ranges of 10W and 50W. Their accuracy is ±10% of full scale deflection. The unit also provides for "RF sampling" with an isolated output for monitoring with a spectrum analyser.



For further details, contact Vicom Australia Pty Ltd, PO Box 366, South Melbourne 3205.

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Gives enthusiasts what they want AND more! Tune into local AM/FM plus LW/MW/SW. Five tuning functions allow either direct frequency key-in, auto or manual scanning and manual rotary tuning. There's a 9 station memory. Five LED signal strength meter. LCD digital frequency display doubles as 24 hour clock. Plus many other fine features.
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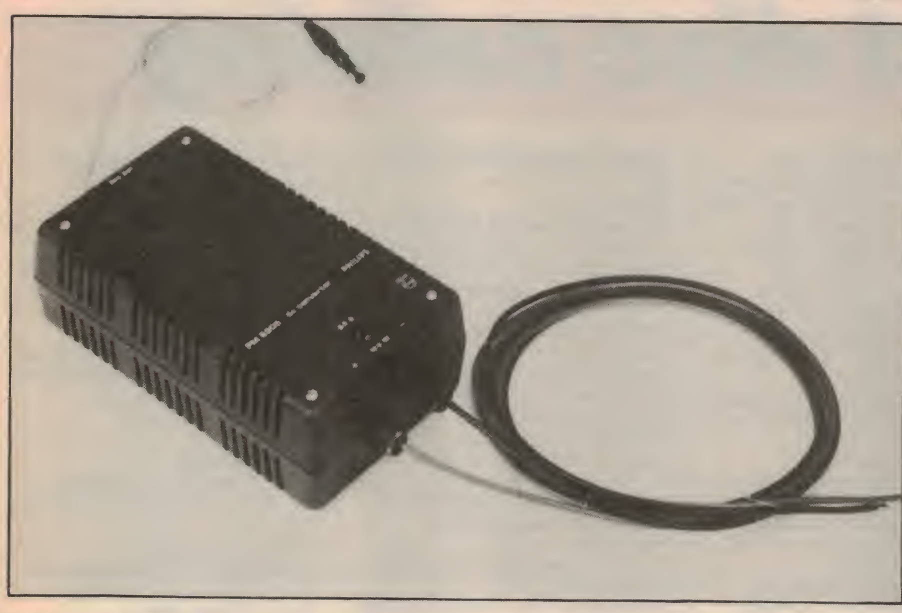


DC-to-DC converter for portable scopes

A 12V to 24V DC-to-DC converter has been introduced by Philips Test & Measuring Instruments for use with many of their portable oscilloscopes.

The PM 8905 is designed to allow all PM 3212/15/17 25 and 50MHz series, PM 3254/56 75 MHz, PM 3267 100MHz and PM 3305 digital storage oscilloscopes to be powered from standard 12V car batteries.

The 12V DC input of the converter is fully insulated from the output and protected against short circuits, overload or incorrect polarity of the input voltage by a 6A/250V fuse.

For further information contact Philips Scientific and Industrial, 25-27 Paul Street, North Ryde 2133. Telephone: (02) 888-8222.

Flat cable tester has digital readout

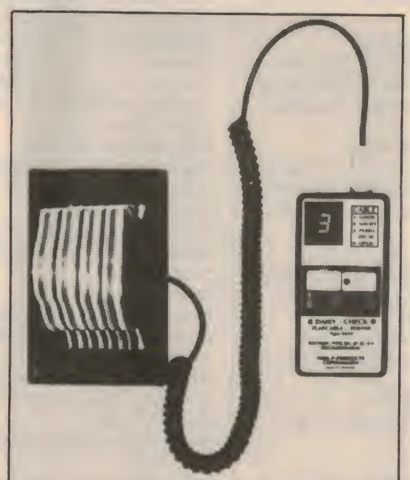
This simple test instrument can be used by anyone involved in the making of factory-tailored flat cables or in the manufacture or repair of equipment incorporating multiconductor cables or harnesses.

The Daisy Check will tell whether the cable is in good order or not and it will indicate any possible defect that may exist.

To operate the instrument the production or suspect cable is plugged into a prepared test fixture, to suit the cable configurations to be tested, the appropriate function selected and then the display is read.

The display shows one of four numerals which indicate a possible cable condition: good-no short-not open circuit; short circuit; intermittent and open.

For further information contact: Warsash Pty Ltd, PO Box 217, Double Bay, NSW 2028. Telephone: (02) 30-6815.



The Daisy Check cable tester features a digital readout and indicates one of four possible cable fault conditions: good, short circuit, intermittent and open.

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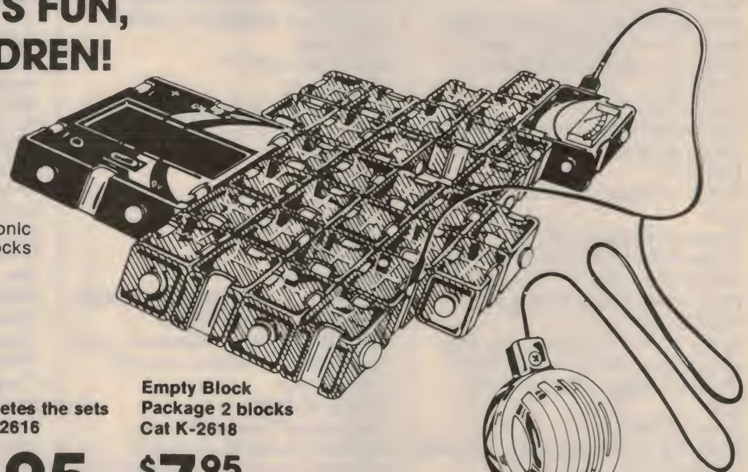

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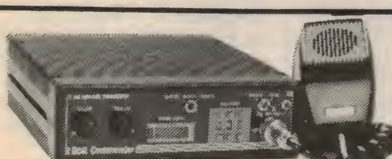

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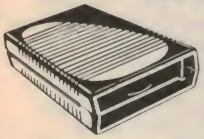

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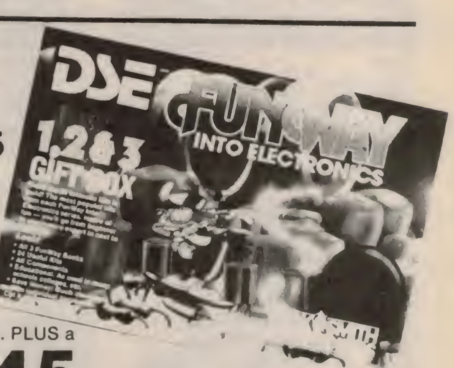

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Psalms 42, 95, 115: Brunner, Ramirez; Huttenlocher; Gulbenkian Foundation Choir and Symphony Orch; Corboz cond.
Erato ECD-88 120
Sonata Op 6; sonate ecossaise, etc: Lydia Artymiw, piano.
Chandos CHAN-8326
Symphony No 3 'Scottish', overture — Midsummer Night's Dream: Bavarian Radio Symphony Orch; Colin Davis cond.
Orfeo ORF C089
Symphony No 4 in A 'Italian'; and No 5 in D minor 'Reformation'. Hungarian State Orch; Ivan Fischer cond.
Hungaraton HCD 12414-2

Symphony No 3 'Scottish'; Symphony No 4 'Italian': Academy of St Martin-in-the-Fields', Neville Marriner cond.
Argo (ZH) 411-931-2
Violin concerto in D minor; piano concerto in A minor: Thomas Zehetmair, violin; Cyprien Katsaris, piano; Franz List Chamber Orch; Budapest.
Teldec 8.43 061
Violin concerto in E minor, Op 64; also — violin concerto No 1 in G minor (Bruch): Jean-Jacques Kantarow, violin; Netherlands Chamber Orch; Antoni Ros-Marba cond.
Denon C37-7123
Violin concerto in E minor, Op 64. Octet Op. 20: St. Paul Chamber Orch; Pinchas Zukerman, violin and director.
Philips (DDD) 412-212-2
Violin concerto in E minor: Cho-Liang Lin, violin.
CBS CD339007
Violin concerto in E minor; plus — violin concerto (Bruch): Itzhak Perlman, violin; London Symphony Orch; Andre Previn cond.
EMI 747074
Violin concerto, Op 64 (version for flute): Andras Adorjan, flute; Stuttgart Radio Symphony Orch; Shallon cond.
Orfeo ORF C046
Violin concerto; overtures Ruy Blas, Midsummer Night's Dream and Hebrides: Joseph Silverstein, violin; Utah Symphony Orch: Joseph Silverstein cond.
Pro Arte PA-CDD 187
Violin concerto; plus — violin concerto (Saint-Saens): Cho-Liang Lin, violin, Philharmonia Orch; M. Tlson-Thomas cond.
CBS CD 39007
Violin concerto; plus — violin concerto No 1 (Bruch): Anne-Sophie Mutter; Berlin Philharmonic Orch; Herbert von Karajan cond.
DG (DDD) 400 031-2
Violin concerto; plus — violin concerto (Tchaikovsky): Kyung Wa Chung, Orch Symphonique de Montreal; Charles Dutoit cond.
Decca (DH) 410-011-2

MEYERBEER

Gli Amore di Teolinda: Varady; Berlin Radio Symphony Orch; Albretch cond.
Orfeo ORF C054

MILHAUD

Chamber music: Nicolet; Holliger; Brunner; Maisenberg.
Orfeo ORF C060

MONTEVERDI

Alti Canti: Les Arts Florissants, Christie.
Harmonia Mundi HM 90.1068
Balli-Balletti: soloists; Monteverdi Choir; English Baroque Soloists; John Eliot Gardiner cond.
Erato ECD-88 032
Coronation of Poppea: Donath; Soderstom; Berberian; Concentus Musicus Vienna; Nikolaus Harnoncourt cond.
Teldec 8.35 247 (4 CDs)
Il Ballo Delle Ingrate; La Sestina: Les Arts Florissants, Christie.
Harmonia Mundi HM 90.1108
Il Combattimento di Tancredi & Clorinda; Madrigal Book: Wener Hollweg; Trudeliese Schmidt; Concentus Musicus Vienna, Nikolaus Harnoncourt cond.
Teldec 8.43 054
Lamento d'Arianna: Concerto Vocale.
Harmonia Mundi HM 90.1129
Madrigals; various performers.
Erato ECD-88 108
Motets: Nelson; Jacobs; Christie; Concerto Vocale.
Harmonia Mundi HM 90.1032
Orfeo — complete opera: A. Michael; C. Watkinson; G. Quilico; Ensemble Vocal de la Chapelle Royale; Lyon Opera Orch; Corboz cond.
Erato ECD-88 133 (2 CDs)
Orfeo — complete opera: Concentus Musicus Vienna; Nikolaus Harnoncourt cond.
Teldec 8.35 020 (2 CDs)
Orfeo: Rogers; Medlam.
EMI 747142
Sacred vocal music: Emma Kirkby, Ian Partridge, Parley of Instruments.
Hyperion HYP CDA66021
Vespers: Taverner Consort and Choir, Andrew Parrott cond.
EMI 747078
Vespro della Beata Vergine: soloists; Ensemble Instruments Anciens; Lausanne Vocal Ensemble; Corboz cond.
Erato ECD-88 024 (2 CDs)
Virtuoso madrigals and sacred concertos: Ian Partridge; Nigel Rogers; Christopher Keyte; Monteverdi Chor Hamburg; Colin Tilney, harpsichord; Jurgen Jurgens, dir.
Archiv (ADD) 415 295-2

MOZART W. A.

Isaac Stern 60th Anniversary Concert — sinfonia concertante in E flat major; plus — concerto for three violins; concerto in D minor for two violins and orch (Bach); Pinchas Zukerman, Itzhak Perlman, Isaac Stern, violins; New York Philharmonic, Zubin Mehta cond.
CBS CD 36692
Quartet in F major, K370; adagio in C major, K58Oa; quintet in C minor, K406; Hansjorg Schellenberger, oboe and English horn; Philharmonia Quartet Berlin.
Denon C37-7034
'London' serenades: Stuttgart Chamber Orch, Karl Munchinger cond.
EMI 860953
'Posthorn' Serenade; Eine Kleine Nachtmusik; Vienna Philharmonic Orch, James Levine cond.
DG (DDD) 410 085-2
Arias from Die Zauberflote (Ach, ich fuhl's); Cosi fan tutte (Ei parte Senti; Per pieta, ben mio, perdona); Idomeneo; La finta giardiniera; Lucio Silla; Il re pastore: Kiri Te Kanawa, soprano; London Symphony Orch; Colin Davis cond.
Philips (DDD) 411 148-2
Church sonatas: London Baroque Ensemble.
Harmonia Mundi HM. 90 1137
Clarinet concerti.
Erato ECD-88 127
Clarinet concerto; concerto for flute and harp; Alfred Prinz; Nicanor Zabaleta, harp; Wolfgang Schulz; Vienna Philharmonic Orch, Karl Boehm cond.
DG (ADD) 413 552-2
Clarinet quartets; D. Kloecker, clarinet; members of Eder Quartet.
Teldec 8.43 046
Clarinet quintet; clarinet trio; Michel Portal, clarinet; Les Musiciens.
Harmonia Mundi HM 90.1118
Complete sonatas for piano, Vol 1: No 1 in C major, K279; No 2 in F major, K280; No 3 in B flat major, K281; No 4 in E flat major, K282; No 5 in G major, K283; Maria Joao Pires, piano.
Denon C37-7386
Complete sonatos for piano, Vol 2: No 6 in D major, K284; No 7 in C major, K309; No 8 in A minor, K310; rondo in D major, K485; Maria Joao Pires, piano.
Denon C37-7387
Complete sonatas for piano, Vol 3: No 9 in D major, K311; No 10 in C major, K330; No 11 in A major, K 331; rondo in A minor, K511; Maria Joao Pires, piano.
Denon C37-7388
Complete sonatas for piano, Vol 4: No 12 in F major, K332; No 13 in B flat major, K333; fantasia in C minor, K475; sonata No 14 in C minor, K457; Maria Joao Pires, piano.
Denon C37-7389
Complete string quartet No 2; Kocian Quartet.
Denon C37-7538
Complete sonatas for piano, Vol 5: No 15 in F major, K533; No 16 in F major, K545; No 17 in B flat major, K570; No 18 in D major, K576; fantasia in D minor, K397; Maria Joao Pires, piano.
Denon C37-7390.
Concert Arias: Kiri Te Kanawa. Wiener Kammerorchester, Gyorgy Fischer cond.
Decca 411 713-2
Concerto for flute and harp; plus — harp concerto in C major (Boieldieu): Lilly Laskine, harp, Jean-Francois Paillard Chamber Orch; J-F Paillard cond.
Erato ECD-88 069
Concerto No 23 in A major, K488; and No 17 in G major, K453; Richard Goode, piano; Orpheus Chamber Orch.
WEA 79042-2
Concertos for horn, No 1-4; Gunter Hoegner; Vienna Philharmonic Orch; Karl Boehm cond.
DG (ADD) 413 792-2
Coronation mass, K317; Missa Solemnis, K337; Soloists; English Chamber Orch, Kings College Choir, Cambridge. Steven Cleobury cond.
Argo (ZH) 411 904-2
Cosi Fan Tutte: Yaker; Nafe; Resick; Feller; Drottningholm Court Theatre Orch and Chorus, Arnold Ostman cond.
L'Oiseau-Lyre 414 316-2
Divertimento (string trio) in E flat major, K563; Mozart String Trio.
Denon C37-7199
Divertimento in E flat: Cummings Trio.
Meridian ECD-84 079
Divertimento No 17 in D major, K334; divertimento No 1 in D major, K136; Philharmonia Quartet Berlin; Norbert Hauptmann, horn; Dieter Fischer, bass; Wolfgang Guetter, contrabass.
Denon C37-7080
Divertimentos, K136-138; serenade in D, K239 'Serenata notturna'; I Musici.
Philips (DDD) 412 120-2
Divertimento in D, K334, march in D, K445; Academy of St Martin-in-the Fields' Chamber Ensemble.
Philips (DDD) 411 120-2
Don Giovanni: Glyndebourne Chorus; London Phil Orch, Bernard Haitink cond.
EMI 747037
Double concerto for two pianos, K365; plus — fantasy for two pianos (Corea); Ping-pong for two pianos (Gulda); Chick Corea and Friedrich Gulda, pianos; Concertgebouw Orch Amsterdam, Nikolaus Harnoncourt cond.
Teldec 8.42 961
Eine Kleine Nachtmusik; six German dances; Les Petits Riens; Scottish Chamber Orch, Raymond Leppard cond.
Erato ECD-88 014
Eine Kleine Nachtmusik, K525; clarinet quintet, K581; Vienna Chamber Ensemble.
Ariola-Eurodisc 610 129-231
Eine Kleine Nachtmusik; A Musical Joke; Scherzo Musicale; Amadeus Quartet; Rainer Zepperitz; Gerd Seifert; Manfred Klier.
DG (DDD) 400 065-2
Eine Kleine Nachtmusik; plus — Holberg suite (Grieg); Symphonie Classique (Prokofiev); Berlin Philharmonic Orch, Herbert von Karajan cond.
DG (DDD) 400 034-2
Eine Kleine Nachtmusic; 'Postarn' serenade.
Telarc 80108
Eine Kleine Nachtmusik: Academy of Ancient Music, Christopher Hogwood cond.
L'Oiseau-Lyre 411 720-2
Exsultate Jubilate; Vesperae solennes de confessore; Kyrie in D minor; Ave Verum Corpus; Kiri Te Kanawa, soprano; London Symphony Orch, Colin Davis cond.
Philips (ADD) 412 873-2
Exsultate Jubilate, K165; Regina coeli, K108; Ergo interest, K143; Regina coeli, K127; Emma Kirkby, Academy of Ancient Music, Christopher Hogwood cond.
L'Oiseau-Lyre 411 832-2
Exsultate Jubilate; arias: Janet Baker,

mezzo.
Erato ECD-88 090
Fantasy and sonatas, K475/457,533/494: Paul Badura-Skoda, piano.
Astree E7703
Flute concerto No 1 in G, K313; oboe concerto in C, K314: Werner Tripp, Gerhard Turetschek; Vienna Philharmonic, Karl Boehm cond.
DG (ADD) 413 737-2
Flute concerto No 1, K313; No 2, K314; concerto for flute and harp, K622: Jean-Pierre Rampal, flute; Marielle Nordmann harp; Jerusalem Chamber Orch, Isaac Stern cond, English Chamber Orch, Rampal cond.
Èrato ECD-88 106
Flute concertos No 1 and 2; andante for flute and orch: W. Schultz, flute; Mozarteum Orch, Leopold Hager cond.
Teldec 8.42 185
Flute concertos: James Galway, flute; Festival Strings Lucerne, Rudolf Baumgartner cond.
Ariola-Eurodisc 610 130-231
Flute quartets: B. Kuijken; S. Kuijken; Lucy van Dael; W. Kuijken.
Accent ACC 48225
Four concertos for horn and orchestra: Zdenek Tyslar, horn; Prague Chamber Orch.
Denon C37-7432
Four early quartets — in F major, K168; in C major, in G minor, K156; Sequioa String Quartet.
WEA 79026-2
Four flute quartets: in D major, K285; G major, K285a; C major, K Anh 171 (285b); A major K298; Aurele Nicolet, flute; Mozart String Quartet.
Denon C37-7157
Great Mass: Barbara Hendricks; Janet Perry; Peter Schreier; Benjamin Luxon; Vienna Singverein; Berlin Philharmonic Orch, Herbert von Karajan cond.
DG (DDD) 400 067-2
Horn concerto No 3, K447; bassoon concerto, K191; oboe concerto, K314; plus — trumpet concerto (Haydn); Dale Clevenger; Willard Elliot; Ray Still; Adoph Herseth; Chicago Symphony Orch, Claudio Abbado cond.
DG (DDD) 415 104-2
Horn concertos No 1-4 Barry Tuckwell, horn; English Chamber Orch.
Decca 410 284-2
Horn concertos: Hermann Baumann, horn; Concentus Musicus Vienna, Nikolaus Harnoncourt cond.
Teldec 8.41 272
Idomeneo — complete opera: Hollweg; Schmidt; Yakar; Mozart Orch and Chorus of Zurich Opera House, Nikolaus Harnoncourt cond.
Teldec 8.35 547 (3 CDs)
Le Nozze di Figaro, K492, highlights; also — Overture Sho Jo Ji (Soeleman); Serenade (Seiber); etc; Netherlands Wind Ensemble.
Denon C37-7124
Le Nozze di Figaro: Te Kanawa; von Stade; Popp; Allen; Ramey, London Philharmonic Orch, Sir Georg Solti cond.
Decca (DH3) 410 150-2 (3 CDs)
March in D major, K249; Serenade No 7 in D major, K250 'Haffner'. Thomas Zehetmair, violin; Staatskapelle Dresden, Nikolaus Harnoncourt cond.
Teldec 8.43 062
Mass in C minor, K427; Lake, Denes, Equiluz; Concentus Musicus Vienna, Nikolaus Harnoncourt cond.
Teldec 8.43 120
Mass in C, K317, Coronation inter natos mulerium, K72; Missa Brevis in C, K220, Sparrow Mass; Vienna Boys Choir; Vienna Symphony Orch, Uwe Christian Harrer.
Philips (DDD) 411 139-2
Missa Brevis in C, K258; Missa Longa in C, K262: Mitsuko Shirai; Marga Schiml; Armin Ude; Hermann-Christian Polster; Leipzig Radio Chorus; Dresden Philharmonic Orch, Herbert Kegel cond.
Philips (DDD) 416 273-2
More of the best of Mozart: Alfred Brendel; Neville Marriner; Colin Davis (and others).
Philips (DDD) 416 273-2
Oboe quartet, K370; divertimento, K251; adagio, K580; Orlando quartet; Heinz Holliger, oboe; Hermann Baumann, horn.
Philips (DDD) 412 618-2
Operatic and concert arias: Barbara Hendricks, soprano.
EMI 747122
Operatic arias: Lucia Popp, soprano.
EMI 747019
Overtures: Academy of St Martin-in-the-Fields, Neville Marriner cond.
EMI 747014
Piano concerto No 14 in E flat, K449; and No 18 in B flat, K456; Diana Ambache, piano; Ambache Chamber Ensemble.
Meridian ECD-84 086
Piano concerto No 23 in A, K488; and

This survey of compact discs has been compiled from listings supplied by all major Australian distributors.

Classical records are catalogued by composer. Pop records — a category we have stretched to include rock, jazz, blues, folk, instrumental and country — are catalogued by artist(s).

Some catalogues which have been published in this country — and indeed in others — are very skimpy on details of artists and works. We have tried to put in as much detail as possible, particularly with classical CDs, consistent with the restrictions of publishing space, without resorting to the use of symbols and contractions with meanings which are hard to remember.

We have, however, retained the useful coding system used by Polygram's Philips and Deutsche Grammophon labels. Numbers of these records are followed by the letters DDD, ADD or AAD to indicate the degree of digital recording technology used in various stages of production. DDD indicates digital tape recorder used during session recording, mixing and/or editing, and final mastering (transcription). ADD indicates analogue tape recorder for session recording, digital equipment for mixing and/or editing and mastering. And AAD indicates analogue recording, mixing/editing and digital mastering.

Numbers and other information throughout are as supplied by the various distributors, and we have put a lot of effort into making the listing as up to date as possible. We have included CDs which were listed for release up to the end of 1985 — but import arrangements can go awry (all CDs sold in Australia are imported). Please bear with us if a few listed CDs turn out to be not available at the time of publication.

We have tried to make the listing as comprehensive as possible. New small importers spring up all the time. If we have missed anyone, we apologise — and ask them to please send information for inclusion in the next survey.

If you have queries about availability of any disc, please contact your record store — or the distributor direct. Following is a list of all major labels and their respective distributors. All have their headquarters in Sydney, with the exception of Teac Aust (Melbourne), PC Stereo (Brisbane) and Another Record Distributor (Hobart).

This catalog has been compiled on a Macintosh computer using Microsoft File by David Frith productions. Below is a list of CD labels and their associated suppliers.

Abbey	Avan-Guard Music
Accent	Argus Music
Accord	Another Record Distributor
Ariola-Eurodisc	Carinia Records
ASV	Another Record Distributor
Asylum	WEA Records
Atlantic	WEA Records
Bellaphon	PC Stereo
BIS	Avan-Guard Music
Black Saint	Avan-Guard Music
Capriccio	PC Stereo
CBS	CBS Records
Chandos	Carinia Records
Chant du Monde	Argus Music
CRD	Argus Music
Decca	Polygram
Delos	PC Stereo
Denon	Teac Aust
DG (Deutsche Grammophon)	Polygram
Durium	Avan-Guard Music
ECM	Carinia Records
Elektra	WEA
EMI	EMI Records
Ensayo	Argus Music
Erato	Carinia Records
Etcetera	Another Record
Festival	Festival Records
Forlane	Carinia Records
GRP	PC Stereo
Harmonia Mundi (Fr)	Argus Music
Harmonia Mundi (German)	Carinia Records
HK (Hong Kong)	Argus Music
HK Marco Polo	Argus Music
Hungaraton	Another Record Distributor
Hyperion	Argus Music
Lodia	Argus Music
MCA	WEA Records
Meridian	Carinia Records
Milan	Avan-Guard Music
MMG	Argus Music
Nimbus	Argus Music
Nonesuch	Another Record Distributor
Orfeo	Argus Music
Philips	Polygram Records Pty Ltd Distributor
Piere Verany	Another Record Distributor
Pro Arte	Avan-Guard Music
RCA	RCA Record
Rodolphe	Argus Music
Schwann	Argus Music
Sefel	PC Stereo and Avan-Guard Music
Sheffield Lab	PC Stereo
Sonic Atmospheres	PC Stereo
Soul Note	Argus Music
Southern Cross	PC Stereo
Supraphon	Argus Music
Telarc	PC Stereo
Teldec	Carinia Records
TER	PC Stereo
Tudor	Argus Music
Unicorn	Another Record Distributor
Varese Sarabande	PC Stereo
Vogue	Another Record Distributor
WEA	WEA Records Pty Ltd

Frith Productions on Microsoft File.

No 26 in D, K537 'Coronation': Friedrich Gulda, piano; Concertgebouw Orch Amsterdam, Nikolaus Harnoncourt cond.
Teldec 8.42 970
Piano concerto No 26; rondos in D and A major: Muray Perahia, piano, English Chamber Orch.
CBS CD 39224
Piano concertos No 1 and 4: Murray Perahia, piano, English Chamber Orch.
CBS CD 39225
Piano concertos No 12 and No 14: Malcolm Bilson, fortepiano; The English Baroque Soloists; John Eliot Gardiner, cond.
Archiv (DDD) 413 463-2
Piano concertos No 12 and No 20: Rudolf Serkin, piano; London Symphony Orch, Claudio Abbado cond.
DG (DDD) 400 068-2
Piano concertos No 12 in A; and No 23 in A: Zoltan Kocsis, piano; Liszt Ferenc Chamber Orch.
Hungaraton HCD 12472-2
Piano concertos No 13 and No 15: Malcolm Bilson, fortepiano; The English Baroque Soloists; John Eliot Gardiner, cond.
Archiv (DDD) 413 464-2
Piano concertos No 15 in B flat, K450; and No 17 in G, K453: Deszo Ranki, piano; Liszt Ferenc Chamber Orch, Janos Rolla cond.
Hungaraton HCD 12655-2
Piano concertos No 17 and 18: Murray Perahia, piano; English Chamber Orch.
CBS CD 36686
Piano concertos No 19 and 23: Murray Perahia, piano, English Chamber Orch.
CBS CD 39064
Piano concertos No 19 and No 23: Maurizio Pollini, piano; Vienna Philharmonic Orch, Karl Boehm cond.
DG (ADD) 413 793-2
Piano concertos No 19 and No 25; Rudolf Serkin, piano; London Symphony Orch, Claudio Abbado cond.
DG (DDD) 410 989-2
Piano concertos No 20 in D minor; No 23 in A: Elisabeth Westenholz, piano; Collegium Musicum Copenhagen/Schoenwandt.
BIS BIS CD-283
Piano concertos No 21 and No 23: Rudolf Serkin, piano; London Symphony Orch, Claudio Abbado cond.
DG (DDD) 410 068-2
Piano concertos No 6 and 13: Murray Perahia, piano, English Chamber Orch.
CBS CD 39223
Piano concertos No 8 and No 27: Rudolf Serkin, piano; London Symphony Orch, Claudio Abbado cond.
DG (DDD) 410 035-2
Piano concertos No 9 and No 11: Malcolm Bilson, fortepiano; The English Baroque Soloists; John Eliot Gardiner, cond.
Archiv (DDD) 415 905-2
Piano concertos No 9 and No 17: Rudolf Serkin, piano; London Symphony Orch, Claudio Abbado cond.
DG (DDD) 415 206-2
Piano concertos No 17 and 24: Vienna Philharmonia Orch; Andre Previn, soloist, cond.
Philips (DDD) 412 524-2
Piano concertos No 20 and 24: Clara Haskil; Lamoureux Orch, Markevitch
Philips (ADD) 412 254-2
Piano concertos No 12 and No 13: Vladimir Ashkenazy, piano; Philharmonic Orch.
Decca 410 214-2
Piano concertos No 15 and No 16: Vladimir Ashkenazy, piano; Philharmonic Orch.
Decca 411 433-2
Piano concertos No 15 and No 21: Alfred Brendel; Academy of St Martin-in-the-Fields, Neville Marriner cond.
Philips (DDD) 400 018-2
Piano concertos No 17 and No 21: Vladimir Ashkenazy, piano; Philharmonic Orch.
Decca 411 433-2
Piano concertos No 19 and No 22: Alicia de Larrocha; Wiener Symphoniker, Uri Segal cond.
Decca 410 140-2
Piano concertos No 19 and No 24: Vladimar Ashkenazy, piano; Philharmonic Orch.
Decca 414 433-2
Piano concertos No 23 and 27: Vladimir Ashkenazy, piano; Philharmonic Orch.
Decca 400 087-2
Piano quartet in G minor, K478; piano concerto in E flat, K439: Beaux Arts Trio; Bruni Giurnna, viola.
Philips (DDD) 410 391-2
Piano sonatas in B, K570; in D, K576; adagio in B minor, K540: Claudio Arrau, piano.
Philips (DDD) 411 1360-2
Piano sonatas, K284, 487; fantasy, K475; Maria Joao Pires, piano.
Erato ECD-88 082
Piano sonatas, in A, K331 Alla Turca; in F, K332; fantasia in D minor, K397: Mitsuko Uchida.
Philips (DDD) 412 123-2
Piano sonatas, in C, K330; in B flat, K333; adagio in B minor, K540; gigue, K574; Mitsuko Uchida.
Philips (DDD) 412 616-2
Piano sonatas, in C, K545; in F, K 533; Rondo in A minor, K511: Mitsuko Uchida.
Philips (DDD) 412 122-2
Quintet in C minor, K406; quintet in E flat major, K614; Josef Suk, viola; Smetana Quartet.
Denon C37-7179
Quintet in A major, K581; plus — Introduction, theme and variations in B flat major (Weber): Sabine Meyer, clarinet; Philharmonia Quartet Berlin.
Denon C37-7038
Quintet in B flat major, K174; Quintet in D major, K593: Josek Suk, 1st viola; Smetana Quartet.
Denon C37-7075
Quintet in E flat major for horn, violin, two violas and cello; serenade in G major; A Musical Joke: Philharmonia Quartet Berlin; Norbert Hauptmann, horn.
Denon C37-7229
Requiem, K626: Kirkby; Watkinson; Rolfe-Johnson; Thomas, Academy of Ancient Music, Christopher Hogwood cond.
L'Oiseau-Lyre 411 712-2
Requiem, K626: Margaret Price: Trudeliese Schmidt; Francisco Araiza; Theo Adam; Radio Chorus Leipzig; Staatskapelle Dresden, Peter Schreier cond.
Philips (DDD) 411-420-2
Requiem, K626: Elly Ameling; Scherler; Devos; Soyer; Gulbenkian Chorus and Orch, Corboz cond.
Erato ECD-88 157
Requiem, K626: Concentus Musicus Vienna, Nikolaus Harnoncourt cond.
Teldec 8.42 756
Requiem: Edith Mathis; Julia Hamari; W. Ocham; Karl Ridderbusch; Hans Haselboeck, organ; Konzertvereinigung; Vienna State Opera Choir; Vienna Philharmonic Orch, Karl Boehm cond.
DG (ADD) 413 553-2
Serenade in D 'Posthorn'; two marches in D, K335, 1; K335, 2: Academy of St Martin-in-the-Fields, Neville Marriner cond.
Philips (DDD) 412 725-2
Serenade K361, 'Gran Partita': Collegium Aureum.
Harmonia Mundi 567-1 99 919-2
Serenade No 10, K361 'Gran Partita': Vienna Mozart Wind Ensemble, Nikolaus Harnoncourt cond.
Teldec 8.42 981
Serenade No 11 in E flat major, K375; and No 12 in C minor, K388: Vienna Mozart Wind Ensemble, Nikolaus Harnoncourt
Teldec 8.43 097
Serenade No 4, K203 'Colleredo': Collegium Aurem.
Harmonia Mundi 567-1 99 989-2
Serenade No 5, K204: Collegium Aureum, F. J. Maier cond.
Harmonia Mundi 567-1 99 958-2
Serenade No 9 in D major, K320 'Posthorn': Staatskapelle Dresden, Nikolaus Harnoncourt cond.
Teldec 8.43 063
Serenade No 6 in D, K239; divertimentos K138 & K287: Academy of St Martin-in-the-Fields' Chamber Ensemble.
Philips (DDD) 412 740-2
Serenade; K185; march K89: Jaap Schroder, violin; Academy of Ancient Music, Christopher Hogwood cond.
L'Oiseau-Lyre 411 936-2
Serenade; K361 'Gran Partita': Academy of St Martin-in-the-Fields; Neville Marriner cond.
Philips (DDD) 412 726-2
Serenade; K525; Eine Kleine Nachtmusik; divertimento in S, K136; A Musical Joke, K522: Academy of St Martin-in-the Fields' Chamber Ensemble.
Philips (DDD) 412 269-2
Sinfonia concertante; violin concerto No 2:
Iano Brown; Josef Suk, Academy of St Martin-in-the-Fields, Neville Marriner cond.
Argo 411 613-2
Sinfonia concertante in E flat K297b; oboe concerto: Aurele Nicolet, flute; Heinz Holliger, oboe; Hermann Baumann, horn; Klaus Thuneman, bassoon; Academy of St Martin-in-the-Fields, Neville Marriner cond.
Philips (DDD) 411 134-2
Sinfonia concertante, K364; concertone K190: Norbert Brainin and Peter Schidlof, violins; English Chamber Orch, Alexander Gibson cond.
Chandos CHAN-8315
Sinfonias concertante K364; K anh 9: Lausanne Chamber Orch, Armin Jordan cond.
Erato ECD-88 113
Sonata in A minor, K310; sonata in C minor, K457: Alfred Brendel, piano.
Philips (DDD) 412 525-2
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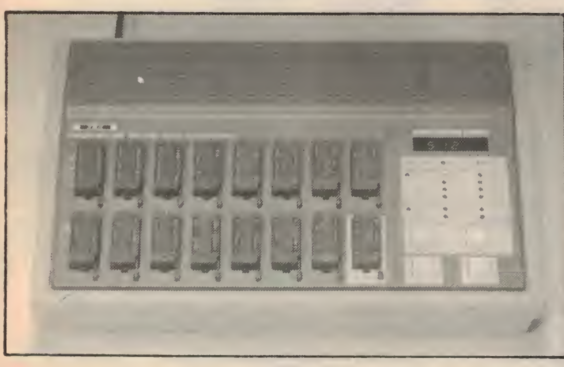

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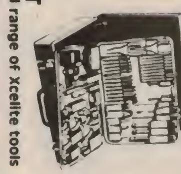

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Winterreise: Martti Talvela, bass; Ralf Gothoni, piano.
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Symphony No 3 'Rhenish'; Overture, Manfred: Concertgebouw Orch, Amsterdam; Bernard Haitink cond.
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TO BE CONTINUED

Due to a limit on space in this issue, we will conclude our listing of classical and popular compact discs in the March issue.

50 and 25 years ago...

"Electronics Australia" is one of the longest running technical publications in the world. We started as "Wireless Weekly" in August 1922 and became "Radio and Hobbies in Australia" in April 1939. The title was changed to "Radio, Television and Hobbies" in February 1955 and finally, to "Electronics Australia" in April 1965. Below we feature some items from past issues.

Wireless Weekly 3d

February 1936

Driverless tractors: in recent years the public's imagination has concurrently been stirred by reported experiments in the field of wireless power transmission and long distance control. Driverless automobiles have been picking their way through traffic, crewless ships ploughing the sea, pilotless 'planes taking off and landing; bombs, rockets and torpedoes shooting unerringly to their mark.

Into this field of scientific experimentation stepped the International Harvester Company with the first radio controlled farm tractor. There is no need (according to the inventors) for a farmer nowadays to sit uncomfortably all day long on the seat of his tractor.

French television: the new high power television transmitter begins in Paris in April; a move to pull down the Eiffel Tower has been met by a demand that the tower shall be saved for television broadcasts.

Maiden voyage: short wave listeners are due for some real thrills when the gigantic trans-Atlantic liner, the Queen Mary, takes to the water shortly. The BBC advises that in co-operation with the Cunard White Star Company, arrangements are being made for broadcasting from this floating palace each evening during the maiden voyage from England to America.

Lifeboat radio: on January 1, new sea-safety regulations were introduced in USA waters. All ocean going passenger vessels of 2500 tons now have the added safeguard of lifeboats with radio telegraph equipment capable of communicating at least fifty miles.

RADIO TELEVISION AND HOBBIES 2/6

February 1961

New RAAF fighter: for many years, the Royal Australian Air Force has been using the Avon Sabre as its front line fighter, but it is now obsolete in this role.

The Federal Government recently announced its intention of equipping the Royal Australian Air Force with the French designed Mirage III fighter.

From the very outset, design of the Mirage has been directed toward attaining the greatest possible versatility in service. The plane is eminently suitable for interception, for tactical support, ground attack, long range bombing and photographic reconnaissance.

Battery powered watch: manufactured by the Bulova Co, the "Accutron" watch is powered by a 1.3V mercury cell, similar to those in hearing aids. Housed beneath a cap in the rear of the case, the cell powers the watch for one year. A recessed control, also on the back of the case, allows the hands to be set.

Checking transistors: leaks in the cases of transistors allow the ingress of water vapour and oxygen, both of which shorten the life of the transistor.

At the moment, the main method of testing is to submit the devices to a humidity test and check the electrical characteristics for deterioration.

An alternative method, which is claimed to be quicker, subject to less error, non-destructive and suitable for large or small quantities, is testing by immersion in radioactive gas. After removal from the gas, the amount inside the component is measured by means of a radiation counter.

Information centre

Power supply for portable refrigerator

Can you please provide me with a design for a mains power supply, as follows: 12VDC negative ground, 4 to 4.5 amps output, regulated to ±0.25V, with ripple voltage not to exceed 10%.

The DC load is nominally constant. The supply is required for a small refrigerator using a thermo-electric heat pump (Peltier effect). Your help would be much appreciated. (R.O., Macleod, Vic.)

• The circuit which would most closely suit your needs is the VK Powermate, published in the December 1983 issue of *Electronics Australia.* This has a nominal 13.8V output at up to 10A but it can be modified to suit your lower output requirement.

To this end, leave out one of the 2N3055 output transistors and one of the 10,000μF filter capacitors, and change the fuse to a 5A rating.

CB-controlled relay

I want a unit to trip a relay via a CB radio at the press of a button. To be more specific, when the CB receives a signal, I want it to trip a relay which will operate a bell or car horn to alert the operator of a specific call.

I envisage using a high pitched tone as the signal to trigger the circuit. The receiver would have a very selective bandpass filter tuned to the same pitch. When the pitch is received for one or two seconds, the relay should be operated.

What I really need your help on is the bandpass filter. Also, I need a way to delay the relay for one or two seconds. Can you help? (H.R., Woodend, Vic.)

• We have just the circuit for you. Back in January 1978, we published a "Selective Tone Caller for CB". We can supply photostats of the article for $4, including postage.

Ignition killer for Kingswoods

I intend to build three of the Car Ignition Killer units described in EA, September 1985. I am not sure how well the unit will operate on a vehicle which is fitted with a ballast resistance type coil (one of my vehicles is a 3.3-litre HZ Kingswood). These only have about 5V when the ignition is turned on, 12V in start position, and up to about 9V when the engine is running.

My question is will these voltages (5V to 9V) be sufficient to operate the unit and then pull in the 12V relay? (J.W., Doncaster, Vic.)

• The circuit is fully compatible with the ignition circuit of the HZ Holden. Indeed, we have not yet come across an ignition circuit which it will not work with. Note that the Ignition Killer should not be powered via the ballast resistor, but should go directly to 12V via the ignition switch.

High-power 300W Inverter

I have constructed the 300W inverter from June 1982 but have encountered several problems with it. Firstly the 1.5A fuse often blows, due to the SCR conducting, when a heavy load is placed on the inverter. When this first happened, I had to replace the SCR, IC1 and IC6. Could this be due to a high voltage spike and if so would a zener diode placed across the +V2 supply cure the problem?

The second problem is that sometimes upon switching it on, the output frequency is 100Hz and it is necessary to switch on and off several times to get a 50Hz output. The transformer buzz is also loud. Is this normal?

The third and most serious problem is

Cure for Playmaster 40/40 oscillation

For some time I have had a problem with the Playmaster 40/40 amplifier which was constructed in 1980. Initially, there was a noticeable hum in the left channel combined with low gain, and the operation of the balance, bass and treble controls was scratchy, both channels being affected. The symptoms disappeared some 15 minutes after turn on and didn't appear to affect the phono inputs to a marked extent.

I sought advice from EA in June or August 1980 when you suggested instability in the T3/T103 emitter follower stages and suggested fitting a 1kΩ resistor in series with the 0.1μF input capacitor to that stage. This was duly done with little effect and on various occasions since I have checked all components through to the power amplifier input stages, replacing some and checking all others and the joints with freon.

Recently I found that touching various components in the vicinity of T4/T5 reduced or cured the problem! A permanent cure seems to have resulted from the fitting of a 0.1μF monolithic bypass capacitor between the +15V preamp power supply rail, where the link to T5 takes off, and the main earth track to the preamp section, the track just being wide enough to take a lead and the monolithic capacitor being a neat fit.

What I don't know is the cause and whether I am masking some underlying fault condition, however the above may be of some interest to you. (J.L., Ravensthorpe, WA.)

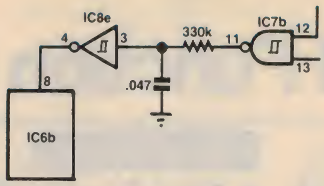
• It would appear that your problem was due to instability of transistor stage T5. Your method of fitting a 0.1μF bypass capacitor is a perfectly valid cure for this problem. It is possible, under the right conditions, for any emitter follower to oscillate. It actually becomes a sort of grounded base oscillator with the inductance of the supply leads forming its collector load.

By connecting a 0.1μF capacitor to the collector of T5, you have very effectively prevented this from happening. However, yours is the first case we have heard of which involved T5 and is possibly due to a transistor with an unusually high gain-bandwidth product.

Multi-Sector Burglar Alarm

Recently, I constructed the Multi-Sector Burglar Alarm Kit. Once installed, I found that the unit was very susceptible to false triggering, even with all sector inputs disabled and the unit running direct from the battery (mains disconnected).

If anyone else has experienced this problem, the cure is shown in the accompanying diagram. Basically, it consists of adding an RC filter circuit to pin 11 of IC7b. In addition, the .01μF capacitor on pin 13 of IC5f should be changed to .047μF to extend the length of the test pulse. (B.H., The Gap, Qld.)



• As far as we know, only a few people have experienced this problem. Thank you for this information.

that the inverter will not operate induction motors or fluorescent lights unless a 4.7μF capacitor is placed across the 240V output. Would the voltage regulation circuit be responsible for this problem? Would the inverter be damaged by permanently connecting a capacitor across the output?

Finally, how accurate is a digital voltmeter when used to adjust the output voltage?

• We hope that you have seen the errata (December 1985) concerning the SCR orientation. It is shown incorrectly on the overlay diagram and should be positioned so that the metal body faces the edge of the PCB. A 16V 1W zener diode across the +V2 supply will prevent any spikes damaging the CMOS ICs and also possibly triggering the SCR.

To prevent the crystal operating in the first overtone mode (8MHz) and therefore giving 100Hz output, we suggest that the 47pF capacitor at pins 1 and 2 of ICIa be increased in value until the problem is cured.

The buzz from the transformer can be reduced by tightening the screws holding the transformer together. However, it normally has some buzz.

A 4.7μF capacitor will not damage the inverter but it should be non-polarised and rated at 250VAC. The problem with the inverter when powering very inductive loads is that the voltage sensing circuit only measures average rather than RMS values. The capacitor corrects for the power factor between current and voltage.

We have found that a digital multimeter which reads average voltage rather than RMS, is accurate enough for voltage settings on this inverter. This is providing a resistive load such as light bulbs is used.

Playmaster Mosfet Stereo Amplifier

I have just completed construction of the Playmaster Mosfet stereo amplifier published in the Dec '80, Jan '81 and Feb '81 issues of *Electronics Australia.* Purchased as a kit from Dick Smith Electronics, I am proud to say that the unit worked perfectly first time. After some testing with a signal generator and a dummy load, and ultimately with program material, the unit gave excellent performance.

I am writing this letter to clear up something I don't fully understand. The problem concerns earthing the input shield and 0V rail to the chassis and therefore to the mains earth.

In the wiring diagram for the chassis wiring, all the shields on the input sockets along with the separate earth terminal are shown connected to the chassis. After tracing the printed circuit board pattern, I confirmed that the 0V rail is connected to the chassis. There is no such connection shown on the wiring diagram.

The article states that the headphone socket must be insulated from the chassis and a separate wire run for the speaker lead return (which I have done). Why is it necessary to insulate the headphone socket if the 0V line is connected to chassis anyway? Furthermore, the two 0.47μF caps connected to the speaker terminals from 0V to chassis are effectively shorted out.

On reading the May '79 issue on the Graphic Equalizer, I noticed that the input shields and the 0V line are not connected to chassis there. Why?

Also, I would like to suggest using a GE MOV varistor (250V) across the mains for spike suppression as I feel this is much more effective than a capacitor.

(I have installed one in my unit). (S.S., Lilyfield, NSW.)

• The headphone socket must be insulated from the chassis to prevent signal return current from flowing in the preamplifier. If this was not done the amplifier as a whole would tend to be unstable and would either motorboat or produce a loud hum output.

At the same time, the two .047μF capacitors connected to the speaker socket render the amplifier less prone to RF interference picked up by the speaker cables. They are shorted out at DC but not at radio frequencies.

As for the Graphic Equalizer, the arrangement of the input shields and the 0V line is to minimize hum and susceptibility to radio interference.

Your suggestion of using a GE MOV varistor for spike suppression is a good one, although most amplifiers seem to be effectively protected by the capacitor specified.

Problem with Musicolour IV

I recently completed a Musicolour IV kit and am using 100W flood lamps similar to those pictured in the EA article. Everything works OK and I am satisfied with the result except for one small problem.

The problem is that at volume levels that I find comfortable, there is insufficient signal to drive the lamps, even with the sensitivity control at maximum.

I have thought of adding a simple amplifier to the input signal external to the Musicolour, but my technical capabilities are very limited. Any suggestions you could make, or a reasonably convenient solution, would be appreciated. (A.M., Gladesville, NSW).

• You haven't stated whether you are driving the Musicolour from the loudspeaker terminals or whether you are using the microphone pickup.

In either case, the best initial approach would be to increase the gain of IC1d by reducing the value of the 10kΩ resistor on pin 14. Similarly, the gain of the microphone preamplifier (IC1a) can be increased by reducing the 10kΩ resistor on pin 1.

Note that halving the resistor value will double the gain of the stage.

Finally, if you have a low-power amplifier, you can also increase the 1kΩ resistor in the input attenuator.

Notes & Errata

12-230V 300VA INVERTER (September 1985, 3/IT/14): the load voltage regulation may be significantly improved by reducing the 1MΩ resistor between pins 6 and 7 of IC7b to 680Ω. While this may appear to be a drastic change, IC7b is within a voltage regulation feedback loop and so the overall effect of such a gain reduction is not great.

To ensure output regulation with varying battery voltage, it is important that the output of the LM317T regulator be no more than 9V. Check this with a multimeter and, if necessary, adjust the values of the resistors connected between the adjust terminal and ground of the regulator for a 9V output.

For example, to reduce the output voltage, reduce the value of either the 680Ω resistor or the 100Ω resistor.

Note that output regulation with large loads can only be achieved by minimising voltage drops in the high current primary circuit. This involves using the recommended 1.6mm diameter wire as indicated on the wiring diagram. In addition, make sure that the terminations between the automative battery clips and the leads are of low resistance. Solder the leads to the clips if necessary.

Finally, the inverter can deliver its maximum capacity of 300VA for short periods of time only (about 20 minutes in a 25°C ambient) before overheating. If it is envisaged that the inverter will be operated continuously at 300VA, larger heatsinking will be necessary.

For continuous loads up to 200VA, the specified heatsinks, which have a thermal resistance of 7.2° C/W, are adequate. Alternative heatsinks should have an equivalent or better thermal resistance.

ELECTRIC FENCE CONTROLLER (December 1985, File 3/MS/119): The part number given for the Philips potcore assembly is obsolete. The current part number is 432202022010 and the part is described as a T26/16, 318 potcore half. Two halves are required for the complete assembly.

Similarly, two Siemens B66339-G-X127 core halves are required, not one as indicated in the parts list.

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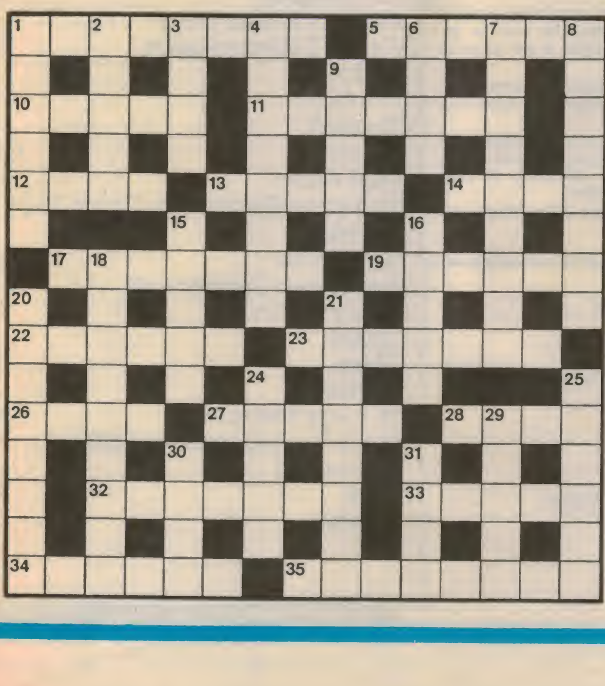
FEBRUARY CROSSWORD

ACROSS

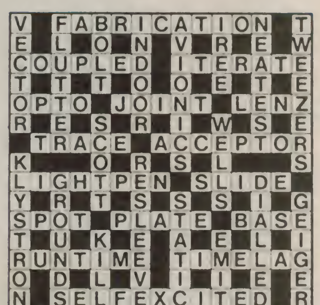
1. Self-contained audio system. (8)
5. A complex radiation. (1,1,4)
10. Kind of printing wheel. (5)
11. Put into symbolic form. (7)
12. Seventh word of phonetic alphabet. (4)
13. Kind of cassette. (5)
14. Form of turntable drive. (4)
17. Common term for an electrical component. (7)
19. Developer of radar, Robert ______ -Watt. (6)
22. Components largely out of date in electronics. (6)
23. Chain of units. (7)
26. Amateur radio systems. (4)
27. Type of connecting lug. (5)
28. Term for part of a TV signal. (4)
32. Element that improves thermionic emission of tungsten. (7)
33. For some, TV games do it. (5)
34. Type of TV tuner control. (6)
35. Gas evolved when charging certain batteries. (8)



DOWN

1. A colour in the spectrum of white light. (6)
2. Initial test. (5)
3. Narrow beams of light. (4)
4. Allow excess current. (8)
6. Function, as selected on tuner, for example. (4)
7. Indicated a data location. (9)
8. You may find dynamos such! (8)
9. Examine data in sequence. (5)
15. Connected by conductors. (5)
16. D-type flip-flop. (5)
18. Kind of clip. (9)
20. What a device may do when you do 4 down. (8)
21. Access to RAMs may be made in such a way. (8)
24. Gate electrodes in a CCD filter may be so arranged. (5)
25. Shield from field. (6)
29. Proponent of the wave theory of light propagation. (5)
30. Component of certain type of speaker. (4)
31. What consists of a position and an electron? (4)

SOLUTION FOR JANUARY



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